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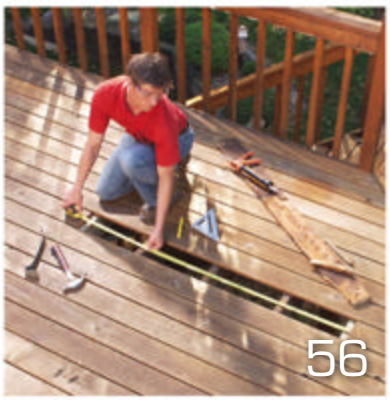
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STUFF we love

BY KEN COLLIER editors@thefamilyhandyman.com



ART DIRECTION ELLEN THOMSON • PHOTOGRAPHY GARY SUNDERMEYER UNLESS NOTED

EVER MORE POWERFUL CORDLESS YARD TOOLS

Not that long ago, battery-powered outdoor equipment was a promising idea, but not all that practical. But battery technology has improved, and the power of modern lithium-ion batteries has grown substantially. First there was 18 volts, then 36 volts, then 40, 56 and now even 80 volts from a single battery! When you combine these honkin' big batteries with new motor technologies, you get tools that compete favorably with their gas-engine cousins. Chain saws powerful enough to cut 18-in. logs all morning. Mowers you can use for huge yards. Trimmers that will run longer than you can.

And boy, do we love the benefits. Reliable push-button starting, quieter operation and no messing with gas (or worse, mixing gas and oil!). You'll find most of the major manufacturers making these next-generation tools: Echo, Ryobi, Oregon, Kobalt, Craftsman, Stihl and Greenworks. Each offers many tools that take the same batteries: mowers, trimmers, chain saws, blowers, pole trimmers, hedge trimmers and more. The new 80V battery from Greenworks will even run a snow blower! Cordless tools cost more up front, but they are super-handy! If you've ever doubted that battery-powered tools would pack enough power for you, give these new ones a try.

THE FAMILY Handyman

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On the House

With the Carey Brothers
Tips of the Month



NATIONAL HARDWARE SHOW 2015

We recently made our annual trek to the National Hardware Show and thought we would share a couple of innovative products that caught our attention.

NEW EASY-TO-INSTALL TOILET BOLTS



Danco, a leading supplier of plumbing repair and replacement parts introduced Zero Cut toilet bolts that makes toilet installation fast and easy, and requires no tools. The product was invented by plumbers to overcome one of the biggest problems associated with toilet installation – toilet bolts that are too long, wobble and are difficult to line up. Zero Cut Bolts offer a viable solution; Two brass T-bolts fit into the toilet flange and are locked into place with threaded nuts that firmly hold the bolt between the flange surface and the flange bottom to prevent wobbling. To help line up the toilet, plastic alignment bullets fit into the T-bolt and have special markings that indicate whether the brass extenders are needed. If so, the extenders fit easily into the T-bolt prior to placing the toilet. Once the toilet is seated, two stainless steel bolt screws fit into the T-bolt and are tightened with a specially designed slide adaptor that turns the bolt and locks the toilet into place. Two low profile bolt caps are included that feature an easy lock and release mechanism and are installed with a simple quarter turn. The Zero Cut Bolts will be available in September at the Home Depot and online at Amazon.com. For more information visit **danco.com**.

EFFECTIVE SPIDER CONTROL

Many people fear or dislike spiders, but, for the most part, spiders are beneficial and can generally be pretty harmless. However, if you don't have a benevolent bent toward spiders, take control in and around your home with Miss Muffet's Revenge spider killer. What's different about this product? Miss Muffet's secret weapon is the built-in precision sprayer. Turn the nozzle to the jet setting and take aim at spiders up to 12 feet away. The 3' flex-hose can be turned at any angle without a hitch to address spiders in the corners and crevasses they love to call home. For indoor use, the manufacturer recommends applying a 4" band along the interior of your home in areas where spiders are a recurring problem. Outdoors, they recommend applying a 12" band of product along the perimeter of your home. In both cases they suggest spraying until slightly wet without soaking. They also recommend that for best results, the product be applied on a clear, dry day when wind and rain aren't in the forecast. To learn more visit **wetandforget.com**.



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JOHNSON HARDWARE

BARN DOORS MOVE INDOORS

Pocket doors are great space-savers in small rooms because you can park a piece of furniture right next to an opening without worrying about a swinging door whacking it. But installing a pocket door after the fact is a major undertaking that may involve rerouting wires, pipes and ducts.

You can get much the same effect, as well as a trendy look, with Johnson Hardware's wall-mounted sliding door hardware. It's similar to old-fashioned barn door hardware, and it offers the benefits of a pocket door without the hassle of installing one. The hardware is easy to mount and can be purchased for one- or two-door-wide openings. The 2610F481 series hardware set shown here, part of the 2610F series, costs $50 with a built-in fascia. It will hold a 125-lb. door. Buy it at jhusa.net.



Hands-free tablets and phones

Here's a simple gadget that makes it easier to entertain your backseat passengers. The GoGear Automotive Universal Tablet Holder straps onto the back of a headrest and uses rubberized elastic cords to keep a firm grip on tablets and phones. Now you can let your kids watch a movie on your iPad or phone without having to worry about them trashing it. At The Home Depot, the GoGear Automotive Universal Tablet Holder is $16.





PIZZA TO GO

My husband, Larry, and I are pretty serious about pizza. Enough so that we built an authentic wood-fired brick pizza oven in our backyard. We often have parties where we churn out dozens of great homemade pies.

But making pizza on the road hasn't been an option—until now. The PizzaQue is a dedicated propane-powered pizza oven (26 lbs.) that's easy to take camping, to the beach, tailgating, to your weekend place—you name it! It takes about 20 minutes for the PizzaQue to heat up, it reaches high temperatures you can't get in a home oven (well over 700 degrees), and it has two built-in pizza stones. The pizzas we baked in it were fantastic! Not quite as good as from our brick oven, but plenty crisp and blistered. And fast, too: about five minutes each. The PizzaQue PC6500 is available at The Home Depot, Cabela's and online for about $200.

Marcia Roepke, Art Director

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BOSCH

A safer saw

Table saws are inherently dangerous. You're always just one distraction away from becoming Four-Finger Freddy. In the last decade, SawStop has revolutionized table saw safety with a blade that stops within milliseconds of making contact with your skin.

Now Bosch has introduced a portable job-site saw with its own flesh-detecting technology. The blade on the REAXX GTS1041A drops down in a fraction of a second when it senses human contact. The advantage over the SawStop technology is that the REAXX does not destroy the blade when the safety mechanism is activated. Getting back to work only involves swapping out a single cartridge, which takes about 60 seconds. Unfortunately, safety comes at a price: The REAXX costs $1,500. But it's still cheaper than the medical and lost-work costs of an accident. Each replacement cartridge ($100) provides two activations (you remove the cartridge and turn it around to get the second shot). The REAXX will be available this fall.

DIY WORK WEAR



WICKING T-SHIRT

Carhartt has introduced a cotton/polyester blend fabric called "Force" that wicks away sweat better than pure cotton does. Last summer I wore a Force T-shirt while building two decks at our summer place. I generally like all-cotton tees, but I quickly became a big fan of these. They not only keep you from feeling clammy and sweaty but also hold their shape really well after repeated washings, and they resist snagging. One chest pocket, lots of colors. They're more expensive than other T-shirts—about $25 to $28 each at carhartt.com—but if you hate to be soaked in sweat, I think you'll like them.

Ken Collier



RYOBI

Better, not bigger

I used to believe that bigger pressure washers were always better. So I bought a big, monster 3,200-psi gas-powered model that I used every spring to clean my deck, wash the siding and blow out my gutters. But I never once used it at full pressure because it would have damaged the siding and deck boards. And I hated how heavy it was and how much floor space it took up in my garage.

I recently decided to downsize to a compact Ryobi electric model. It's lightweight (just 25 lbs.) and small (fits on an 18-in. shelf), and it's plenty powerful enough (1,600 psi) for all my cleaning jobs. It has all the features of my other machine for less than a third the price, and now I don't have to mess around with gas. I passed along my old pressure washer to my son, who still has a strong back and a three-stall garage. I bought my Ryobi RY141600 at The Home Depot for $109.

Rick Muscoplat, Contributing Editor

the art of doing



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Handy HINTS®

FROM OUR READERS handyhints@thefamilyhandyman.com

EDITOR DAVID RADTKE • ART DIRECTION MARCIA ROEPKE • PHOTOGRAPHY TOM FENENGA



HIGH AND DRY

We keep our wet boots in a boot tray by the door. The boots used to sit in water all day and never really got dry. Then we decided to elevate them from the tray using some old cookie cooling racks. Now they're dry when we put them on, and the water evaporates from the tray more quickly.

Robert Henikman



Small-parts solution

We buy chewing gum in these nifty reusable plastic containers. The tops open completely and they have a smaller opening that works great for dispensing small hardware items. We just glue one of the parts to the top so we can quickly identify the contents.



Jerry Bullock



Emergency mixing paddle

I needed to mix up some joint compound but couldn't find my mixing paddle. Then I looked up and saw a bike hook screwed into a joist. I removed the hook, chucked it into my drill and was pleasantly surprised how well it blended the mix!

Al Herrero

Get a $100 gift card for your Handy Hint! See p. 4.



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Under-sink organizer

To tame the clutter under our bathroom sink, I made this organizer from scraps of 3-in. PVC. I cut the pipe into short lengths and then glued them to 1/2-in. plywood with polyurethane construction adhesive. I spaced the pipe pieces to accommodate liquid soaps, shampoos and other bottles and left spaces between the pipe sections for odd-shaped spray bottles. Now things organized and don't topple over every time we reach for something.



Dan Nashold



Tape measure markup

When a project requires lots of similar measurements—jobs like roofing and siding—I minimize mistakes by marking my tape measure. It's best to choose a permanent marker and use different colors for different lengths. When I no longer need the marks, I erase them with a rag and a little acetone.

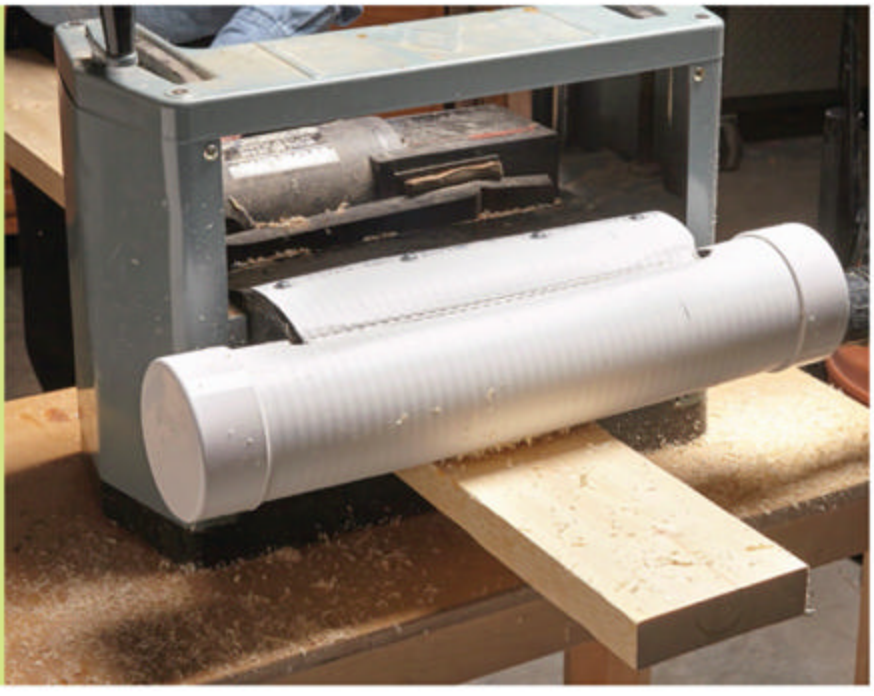
Steve Wilson

WOOD CHIP CATCHER

My planer blasts shavings all over the shop floor. I decided to make my own dust chute from 4-in. PVC sewer pipe (which has thinner walls than regular Schedule 40 pipe) and a couple caps. I cut a slit in the pipe and used a heat gun to soften the plastic. That allowed me to open the slit. (Heating PVC releases fumes; ventilation is critical.) I then drilled holes in the flap and screwed it to the planer housing. Finally, I cut a 2-1/2-in. hole in one of the end caps to accept my shop vacuum hose. Works great!



Luis Arce



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MECHANIX WEAR

PERFECTLY PRACTICAL SHED



What makes this shed so hard working? Well, for starters it has a pair of large sliding doors—you can open just one for normal use, or both if you need to move large items in or out. Inside the shed are three walls that are uninterrupted by windows, allowing plenty of space for shelves or hanging storage. Ventilation is taken care of by screens placed between the top and bottom ends of the rafters. And the row of high windows over the doors provides plenty of light. There's even a covered outdoor storage area on the back of the shed that's ideal for firewood, wheelbarrows and other bulky stuff.

The construction couldn't be easier. There are no fancy rafter cuts to make. And the siding is simply 4 x 8-ft. and 4 x 9-ft. sheets of 1/2-in. material covered by 1x2 battens. If you've never tackled a big project, this shed is a perfect one to start on.

by Jeff Gorton
editors@thefamilyhandyman.com

JEFF'S FIVE INGENIOUS FEATURES

My mission was to design a shed that had plenty of light, good ventilation, easy access and lots of storage options. Here's what I came up with.

1. Site-built screens and windows provide light and ventilation.

2. High windows let in light without sacrificing security or wall space.

3. The roof is easy to build and covered with steel roofing.

4. Large sliding doors are handmade to save money and provide a custom look.

5. A raised, covered storage area on the back keeps firewood and other large items out of the weather.





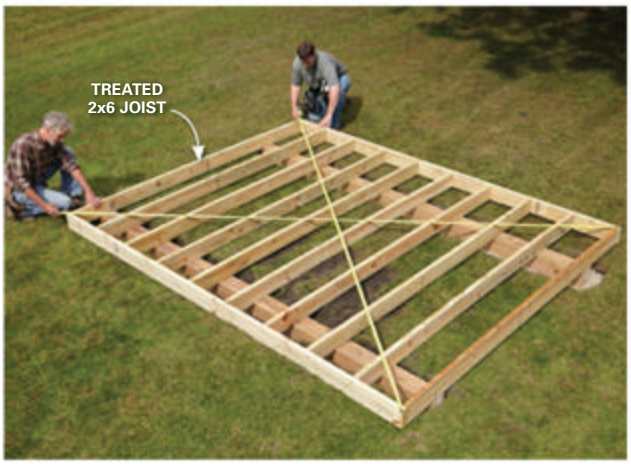

3


4


5



1 LEVEL THE SLEEPERS
Set treated 6x6 sleepers on level beds of gravel. Tamp down the sleepers to level them.



2 SQUARE THE FLOOR
Nail the joists together. Make sure diagonal measurements are equal. Then nail or screw the joists to the beams and add hurricane ties.



3 LAY THE FLOOR
Nail treated plywood to the joists, staggering the seams. A nail gun speeds up the work.



4 BUILD THE FRONT WALL
Cut the plates, studs and other parts to length according to Figures C and D (online). Mark the door and stud locations on the plates and assemble the wall.

ART DIRECTION **MARCIA ROEPKE** • PHOTOGRAPHY **TOM FENENGA** • TECHNICAL ART **MARIO FERRO**

Money, time and tools

You'll find most of the materials to build this shed at home centers or lumberyards. We found the corrugated metal roofing at a local home center, but you may have to order it. We special-ordered 4 x 9-ft. sheets of siding, but if you don't mind a few small horizontal seams, you could use 4 x 8-ft. sheets instead.

You'll need standard carpentry tools including a circular saw and drill to build this shed. A power miter saw and table saw would save you time and help you get perfect cuts on the trim pieces. But they aren't necessary. A framing nail gun and compressor will speed up the framing. You'll also need a pocket screw jig to build doors like ours.

There are no tricky cuts or complicated walls to build. Even if you've never tackled a large project, you'll be able to build this shed. It's always good to have some help, though. And if you have friends with some carpentry experience, that's even better. With a helper or two, you should be able to finish the floor and walls the first weekend. Then expect to spend a few more weekends building the roof and finishing the siding, doors and windows.

Getting started

Check with your local building department to see whether a permit is required for a shed of this size. Also ask about restrictions on where the shed can be placed on your lot, and if a survey is required. Do this a few weeks before you plan to start so you don't get held up by the permit process.

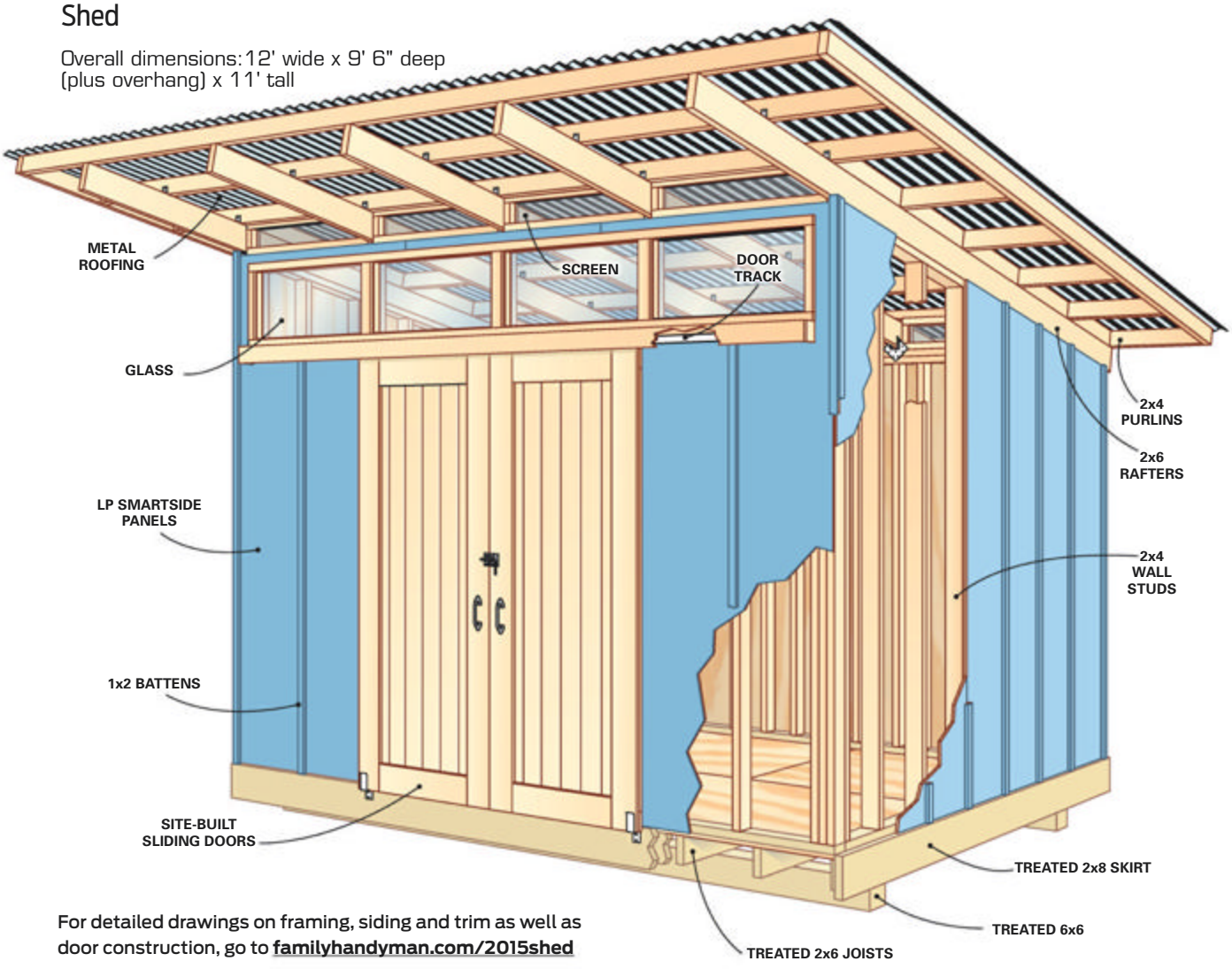
A few weeks before you plan to build, take the Materials List (you'll find it at familyhandyman.com/2015shed) with you to your favorite lumberyard or home center and go over the list with the salesperson to see what items you may have to order. Then set up a delivery so you'll be ready to build when your help arrives. A few days before you plan to dig the trenches for the sleepers, call 811 for instructions on how to locate buried utility lines.

Build the floor

Our shed floor consists of treated 2x6 joists resting on treated 6x6 sleepers. You could also pour a concrete slab, or

Figure A
Shed

Overall dimensions: 12' wide x 9' 6" deep (plus overhang) x 11' tall



For detailed drawings on framing, siding and trim as well as door construction, go to **familyhandyman.com/2015shed**





5 NAIL ON THE SIDING
Align the bottom plate with a chalk line and tack it down with toenails. Measure diagonally to square the wall. Then tack the top corners. Cut the siding to fit and nail it to the framing.

6 PLUMB AND BRACE THE FRONT WALL
Stand the wall and align it with the chalk line. Nail through the bottom plate into the floor. Adjust the wall until it's plumb. Then nail on a brace to hold it.





7 CHECK THE WALLS FOR PARALLEL
Plumb and brace the back wall. Then measure between the walls at both the top and the bottom. The measurements should be equal. If not, use a level to double-check for plumb, then adjust the walls as needed.

8 MARK THE RAFTERS
Using Figure E (online) as a guide, mark the location of the purlins on the rafters.



9 INSTALL THE RAFTERS
Mark the rafter locations on the top plates using Figure E (online) as a guide. Extend the rafters 23-1/2 in. past the siding on the back wall and toenail them to the wall. Finish by installing the metal hurricane ties (inset photo).



10 LAY OUT END-WALL STUDS
Position the first stud (Figure F, online). Then measure over multiples of 16 in. to mark the location of the remaining studs.

WHAT IT TAKES

COST: $2,800
TIME: Three or four weekends
SKILL LEVEL: Intermediate to advanced
TOOLS: Standard hand tools, a circular saw and a drill. Nice, but not necessary: table saw, miter saw, nail gun and jigsaw

build the floor like a deck with beams resting on post footings.

The first step is to determine the location and height of the 6x6 sleepers. We used stakes and level string lines, but another easy method is to build a 9-ft. 6-in. x 12-ft. rectangle from 2x4s to represent the shed perimeter. Square and level the rectangle and use it as a guide to locate the sleeper trenches. Drive stakes to mark the center of the sleepers. The stakes should be 14-3/4 in. inside the front of the shed, and 20-3/4 in. from the back. Dig trenches about 12 in. wide and about 10 in. below where you want the bottom edge of the joists to end up. Pour 4 in. of gravel into the trenches and level it off. Make sure the gravel in both trenches is at the same level. Then cut the 6x6s to 12 ft. long and set them in the trenches. Measure to make sure the 6x6s are parallel. Then measure diagonally from the ends to make sure they're square. The diagonal measurements should be equal. Lay a straight board and a level across the sleepers to check for level (**Photo 1**). If the sleepers need to be adjusted, tamp them down with a sledge or heavy board to level them.

When the sleepers are level, you can build the floor. Start by cutting the 12-ft.-long rim joists for the front and back and marking the joist locations on them (**Figure B** online). You'll cut the 2x6 floor joists and build the floor on top of the 6x6s (**Photo 2**, and **Figure B** online). Measure diagonally to square the joists (**Photo 2**). Sight down the 12-ft. rim joist to make sure it's straight. Then connect the joists to the 6x6s with metal hurricane ties. Finish the floor by nailing the 3/4-in. treated plywood to the joists (**Photo 3**).

Build the walls

For speedier construction, build the front and back walls on the shed floor and install the siding before standing the walls up. Then build the side walls in place after the rafters are installed.



11 FASTEN THE PURLINS
Line up the purlins with the marks on the rafters and secure them with metal angles. Make sure they extend 21-1/2 in. past the rafters on each end.



12 BUILD THE SCREENS
Cut 2x2s and screw them together for the frames. Staple screening to the 2x2s and add 1x2 screen moldings over the screen.



13 INSTALL THE SCREENS
Slide the screens between the rafters. Rest the top edge against the purlin. Drive a few screws through the 2x2s to hold the screens in place.



14 START THE ROOFING
Hold the top edge of the metal 2 in. beyond the top purlin. Position the sheet of metal roofing so that 2 in. hangs over the side.

First, measure in 3-1/2 in. from the edges of the floor and make marks to indicate the inside edges of the walls. Snap chalk lines between the marks. These lines provide a reference for straightening the bottom plate of the walls after the walls are standing. Cut the bottom plates from treated 2x4s. Cut top plates for the front and back walls only. Using **Figures C and D** online as a guide, mark the plates for the studs and the door and window openings.

Arrange the plates, studs and other parts for the front wall on the shed floor and nail them together (**Photo 4; Figure C** online). Prepare the wall for siding by aligning the bottom plate with the chalk line and securing with screws or angled nails. Next, square the wall by adjusting it until the diagonal measurements are equal. Tack the top corners to the floor to hold it square. With the wall straight and square, you can safely nail on the siding (**Photo 5**). Keep the lower edge of the siding flush to the bottom plate. You can cut out the door and window openings before you install the siding, or use a router and panel bit like we did to cut them out after the siding is nailed in place. Stand and brace the front wall (**Photo 6**). Then build and stand the back wall (**Figure D** online) using the same process. Brace the two walls and check to make sure they're plumb and parallel (**Photo 7**).



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Install the rafters

To save time and avoid the difficult task of applying finish to the rafters and purlins later, we applied two coats of a transparent exterior sealer before cutting and installing the rafters and purlins. After you've done this and the finish is dry, cut five rafters and stack them on your sawhorses with the ends aligned. Using **Figure E** online as a guide, mark the location of the purlins along the top of the rafters (**Photo 8**). Also mark the bottom side of the rafters, 23-1/2 in. from the lower end to indicate where the rafters align with the siding on the back wall. Use this mark to line up the rafters so they extend an equal distance from the wall. Next, mark the location of the rafters on the top plate of the front and back walls. Screw or nail the rafters to the plates. Then connect the rafters to the plates with hurricane ties (**Photo 9**, inset).

Complete the side walls

Cut the top plates for the side walls to fit between the front and the back walls and nail them up. **Photo 10** shows one way to mark the stud locations on the top plate. Measure between the top and the bottom plates at the stud locations to get the stud lengths. Then cut the studs to length, with a 12-degree angle on the top, and nail them in. Finally, cut the roof pitch on the siding and nail it to the walls (**Figure F** online).

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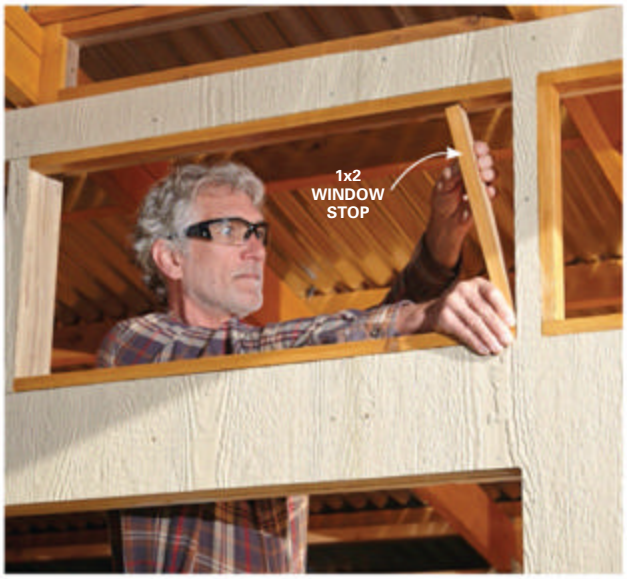
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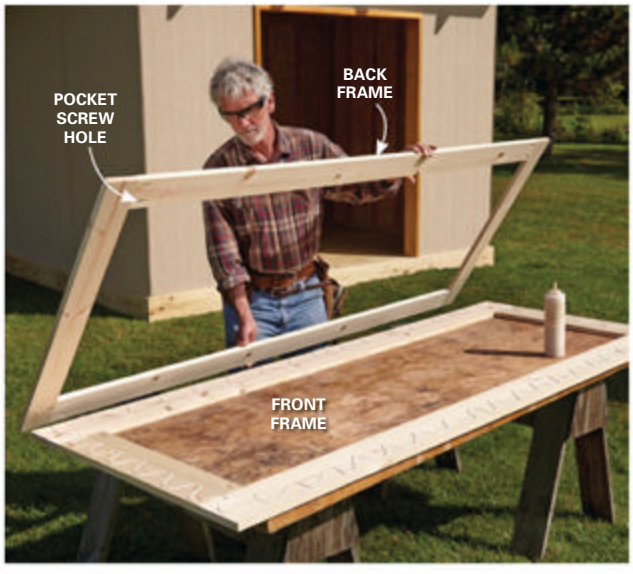
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16 ADD THE WINDOW STOPS
Nail 1x2 stops inside the window openings, flush with the siding. Cut a second set of stops to go on the inside after the glass is installed.



17 SET THE GLASS AGAINST THE STOPS
Apply a bead of silicone caulk to the 1x2 stops. Tilt the glass into place against the stops. Then add another set of 1x2 stops to hold the glass in place.



18 BUILD THE DOOR FRAMES
Assemble the two frames with pocket screws. Spread waterproof wood glue. Then drive screws through the back frame into the front frame.



19 ADD THE DOOR PANEL
Cut 1x6 tongue-and-groove boards to fit the opening. Attach them with one screw in the center of each board.

Add the purlins

Cut the purlins to length and make a mark on each one, 21-1/2 in. from one end. Line these marks up with the end rafter when you install the purlins to ensure that the overhang is uniform and the ends of the purlins are lined up. Attach a purlin at each of the locations you've marked (**Photo 8**) on the top of the rafters. Use metal angle brackets to attach the purlins (**Photo 11**).

Build and install the screens

The screens are simply 2x2 frames with window screen stapled to them (**Photo 12**, and **Figure G** online). After you've stapled screen to the 2x2 frames, cut 1x2s the same lengths as the 2x2s and nail or screw them over the screening to finish the screens. Slide the screens into place between the rafters above the front and back walls. Rest the top edges against the purlins and secure the screens by driving a few screws through the sides into the rafters (**Photo 13**).

Install the metal roofing

We ordered galvanized, corrugated steel roofing panels, but you can use any style metal roofing you like. The roof is sized to accommodate panels that are 26 in. wide (24 in. actual coverage) and 14 ft. long. If you leave 2-in. overhangs all around, you won't have to cut any panels.

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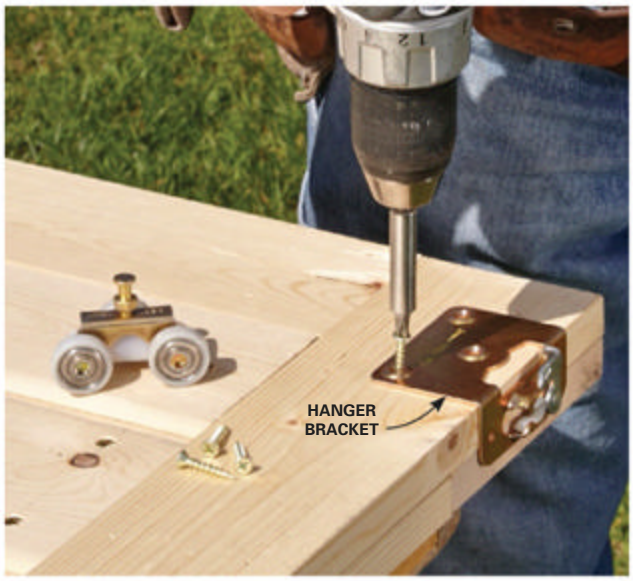
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20 INSTALL THE DOOR HANGERS
Attach the hanger brackets to the doors with the included screws.



21 MOUNT THE TRACK
Screw a ripped-down 2x4 to the studs, just below the window trim. Cut the tracks with a hacksaw so they meet in the center. Screw the tracks to the 2x4.

Before we started applying the panels, we placed strips of self-adhesive, compressible foam along the purlins directly over the front and back walls, and along the blocking over the side walls. The strips keep out insects by sealing the gaps created by the corrugations. If you're using foam strips with the "wave" shape built in, it may be easier to apply the strips as you install each panel.

It's important to get the first panel lined up correctly (**Figure H** online). Set the panel in place and position it to extend 2 in. past the top purlin (**Photo 14**). Then adjust the panel until it overhangs the side by 2 in. Check the side overhang measurement at the top and bottom to make sure the panel is parallel to the side. Then secure the panel with special roofing screws placed 8 in. apart, on every other purlin. Don't put any screws along the edge yet. You'll add those screws after you install the next panel (**Photo 15**). Drive all the screws into the first panel. Then set the panel in place, overlapping it onto the first panel by one corrugation. Check the measurement at the top. If the top overhang starts to deviate as you install more panels, you may have to cheat each panel slightly to maintain a consistent overhang.

Set the window glass

The windows are panes of 1/8-in. glass set against 1x2 stops and held in with another set of 1x2 stops on the inside. Cut the 1x2s to fit inside the openings. Then set them flush to the siding and nail them to the 2x4 framing (**Photo 16**, and **Figure G** online). We've listed the glass size in the Materials List (online), but it would be a good idea to double-check the measurements of the actual openings before ordering the glass. Subtract 1/4 in. from the opening height and width to arrive at the glass size needed. Most hardware stores will cut window glass to size. We set the glass against a bead of silicone caulk (**Photo 17**), but this is optional. Set the glass against the 1x2s. Then nail or screw the interior 1x2 stops to hold the glass in place.

Build and install the doors

The site-built sliding doors are easy to make from standard 1x4 and 1x6 No. 2 pine boards. The trick is to choose boards that are straight and flat. Start by making the front and back layers (**Figure J** online). You'll need a pocket hole jig for this. You can buy a pocket hole jig at home centers or online. Go to familyhandyman.com and enter "pocket screw" in the search box for information on how to use the jig.

Glue and screw the two layers together to make the door (**Photo 18**). If the edges don't line up perfectly, you can plane or sand them later. Finish the doors by adding the 1x6 tongue-and-groove boards (**Photo 19**). We used 1x6s with a bead pattern running down the center, but you can choose any material you like to fill the panel.

The doors hang from brackets with ball-bearing wheels, and slide on an aluminum track. Screw the hanger brackets to the two doors, with the overhanging part of the hardware on the back side of the doors (**Photo 20**). Then attach the rollers.

Use 4-1/2-in. structural screws to attach the 2-3/4-in. x 1-1/2-in. board just under the window trim. Drive the screws into the wall framing. Then cut the two pieces of track to length so they join in the center of the door opening. Screw the tracks to the support board, making sure to hold the front edge of the track back 1/8 in. from the front edge of the support board.

MEET THE EXPERT

Before starting work at The Family Handyman, Jeff spent more than 15 years as a remodeling contractor. He built additions and garages and handled whole-house renovations as well as kitchen and bathroom remodeling. He used knowledge gained from these jobs to design and build the shed you see here.

With the track mounted and the hangers attached to the doors, get help to lift the doors and slide the hangers into the tracks. You'll need a doorstop inside the track at each end and in the center. You can order these when you order the door hardware (see the Materials List online), or you can make your own stops from small pieces of wood that are cut to fit into the track and attached with screws. The end stops prevent the doors from hitting the end valance pieces and knocking them off. Finish the door installation by cutting the 1x4 valance and nailing it to the support board to cover the front and sides of the track. We screwed "open bar holders" to the skirt board on each side of the door opening to prevent the bottom of the doors from swinging out (**Figure K** online).



22 ADD THE BATTENS
Center the first batten over a stud and nail it. Hook your tape on the batten and make marks at 16-in. increments for the rest of the battens.

Finishing up

Complete the shed by installing the 1x2 battens (**Photo 22**, and **Figures K and L** online). On the sides, cut angles on the batten tops to match the angle of the siding. Leave a 1/8-in. space between the bottom of the battens and the 2x8 skirt board to prevent water from soaking into the end grain.

We painted the siding and trim with top-quality acrylic exterior paint, and protected the doors, rafters and purlins with two coats of transparent exterior finish. We also covered the interior walls with smooth plywood and added shelves. You can customize the shed to work best for you, whether that's adding a workbench or potting bench, or just hanging gardening tools from the bare studs.



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ADD KITCHEN OUTLETS

Run new wiring without wrecking walls

by **Mark Petersen**
editors@thefamilyhandyman.com

Not that long ago, the average kitchen counter was home to a toaster, coffeemaker and maybe a blender, but things have changed. We now have juicers, bread makers, TVs, gourmet pizza ovens, computers and charging stations for a half-dozen mobile gadgets. It's not surprising that it's getting harder to find an available outlet to plug in all that stuff. Extension cords and power strips are unsightly and can be dangerous. The only real solution is to add more outlets.



WHAT IT TAKES

TIME: About 4 hours
COST: $80
TOOLS: Screwdriver, wire stripper/cutter, jab saw, hacksaw, drill, 1-in. spade bit
SKILL LEVEL: Intermediate

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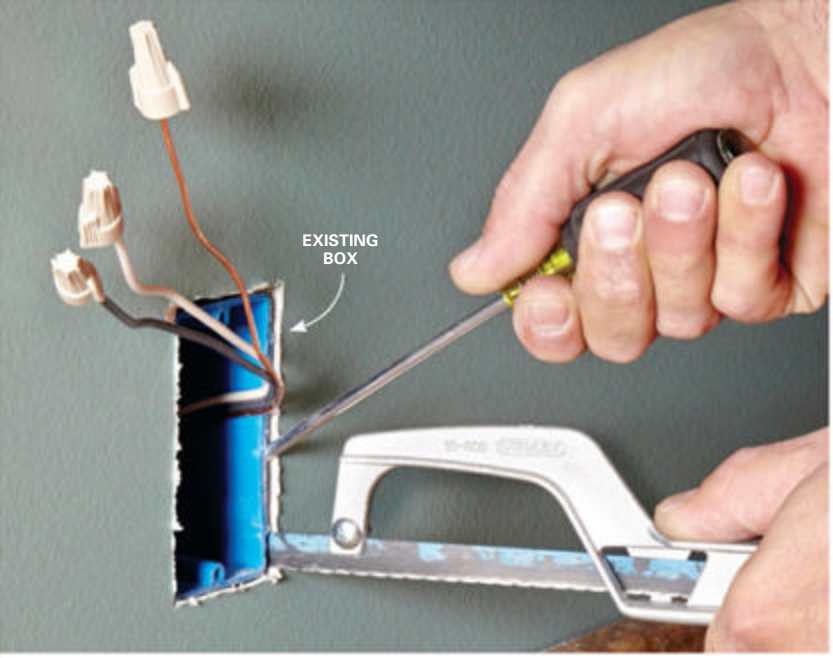
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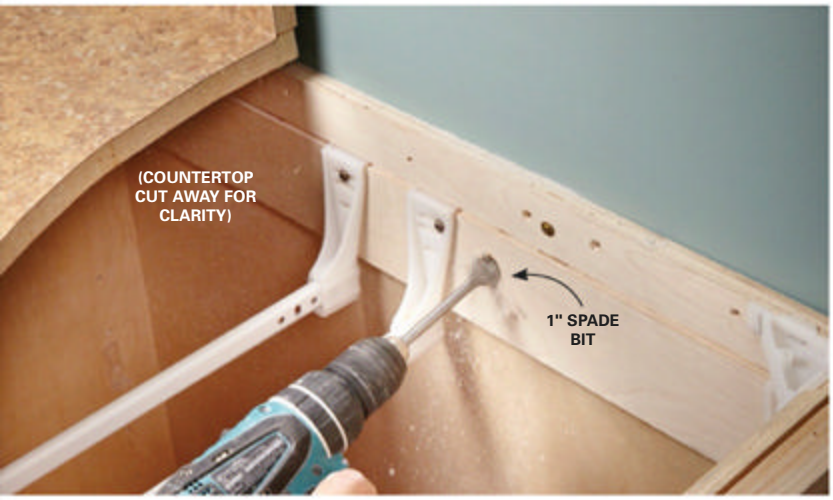
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1 CUT OUT THE EXISTING BOX
Cut off the nails on the existing box. Wedge a screwdriver between the stud and the box to make room for the hacksaw blade.



2 CUT A HOLE FOR THE NEW BOX
Trace the outline of the box on the wall at the same height as the existing box, and cut out the drywall with a jab saw. Keep the hole an inch or more away from any studs.



3 DRILL HOLES FOR THE CABLE
Drill 1-in. holes through the back of the cabinet and drywall. Beware of hidden cable, ducts and pipes; when the bit breaks through the drywall, stop.

MEET THE EXPERT



Tim Johnson works for Norske Electric in Savage, MN. He works on both commercial and residential projects, and even spent a few years wiring wind turbines 265 ft. in the air!

We tracked down an electrician who, not surprisingly, adds kitchen outlets all the time. He showed us how he adds an outlet to a kitchen backsplash by running conduit through the back of the cabinets. This method is fast, inexpensive, super simple, and best of all, doesn't require a whole bunch of wall repairs or painting. This article shows how to install one new outlet, but you can add several by following similar steps.

Before you get started

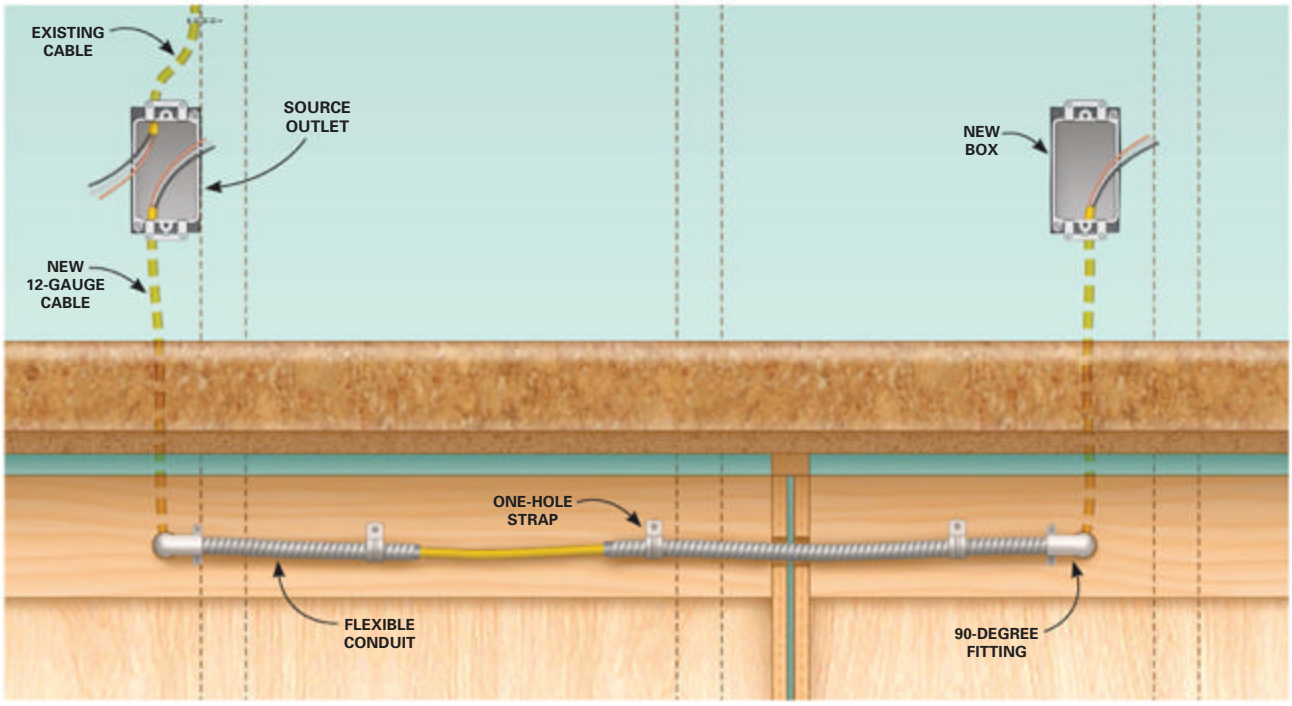
Kitchens need to be on a dedicated 20-amp circuit and require 12-gauge wire. Today, 12-gauge wire is wrapped in a yellow sheath, but your old cable may be white. New circuits in kitchens need both arc fault and ground fault circuit interruption (AFCI, GFCI) protection. In this story, we're adding an outlet to a kitchen that already has GFCI protection, which has been required for many years. If your kitchen is not on a 20-amp circuit, or doesn't have GFCI protection, you'll have to install a new circuit or circuit breaker. For more information, go to familyhandyman.com and search for "new circuit." Also, discuss your project with your local electrical inspector when you apply for a permit. If adding a circuit still seems above your pay grade, then call an electrician.

Remove the existing box

The first step is to shut off the power. If your breaker panel is poorly labeled, plug a radio into the outlet you plan to pull power from, and start shutting down breakers until the music stops. There may also be wires from other circuits in the junction box, so probe the box with a noncontact voltage tester ($10 at home centers) before you disconnect any wires. Cover the ends of the existing wires with wire nuts as an additional precaution. **Caution:** If you discover aluminum wiring, call in a licensed

ART DIRECTION **VERN JOHNSON** • PHOTOGRAPHY **TOM FENENGA** • ILLUSTRATION **FRANK ROHRBACH III** • CONSULTANTS **TIM JOHNSON, and JOHN WILLIAMSON, MASTER ELECTRICIAN**

Figure A Diagram of new cable and conduit



electrician who is certified to work with it. This wiring is dull gray, not the dull orange that is characteristic of copper wire.

It's easier to fish the new cable if you remove the existing box in the wall. Fiberglass boxes can be busted out with a hammer and a chisel or sturdy screwdriver. It's best to cut the nails on plastic boxes with a hacksaw. Start by probing with a screwdriver to find which side of the box the stud is on. Then pry the screwdriver between the stud and the box to make room for the saw blade (**Photo 1**).

Metal boxes are difficult to remove without creating some drywall repairs. Before you attempt it, see if you can fish the cable down through the existing metal box into the hole in the cabinet.

Cut a hole for the new box

There's no rule mandating the height of the new box, so just match the height of the existing one. The code for kitchens states that there must be an outlet within a 2-ft. reach from anywhere along the countertop, excluding those areas where there's a sink or stovetop. This means there should be an outlet every 4 ft. If you're just adding one outlet, you probably won't be subject to this rule, but if you're remodeling the entire kitchen, you probably will. It's best to check with your local electrical inspector.



4 FISH IN THE NEW CABLE
Slide the new cable through the drilled hole, then up and out through the electrical box hole. Put a slight bend on the cable so it hugs the wall and doesn't get hung up on insulation.

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Before cutting the hole, go to the floor below and, if possible, check to see if there are any pipes or ducts running through the wall you plan to cut into. Or go outside and see if any vents are sticking through the roof in that area. If you're not sure, make a small exploratory hole that can be easily patched.

The new box does not have to be right up against a stud. In fact, it's easier to install if it's not. Trace around the new box, and cut the hole with a jab saw (**Photo 2**). Don't shove the saw all the way into the wall cavity, just in case there's a wire or pipe hidden behind the wall.

If your backsplash is tiled, use a rotary tool fitted with a diamond tile-cutting bit. Set the depth of the bit so it cuts through the tile only. Finish the cut with a jab saw. Whenever possible, use the grout lines for two sides of the hole because cutting will be much easier. Drill starter holes in two opposite corners with a glass-and-tile drill bit.

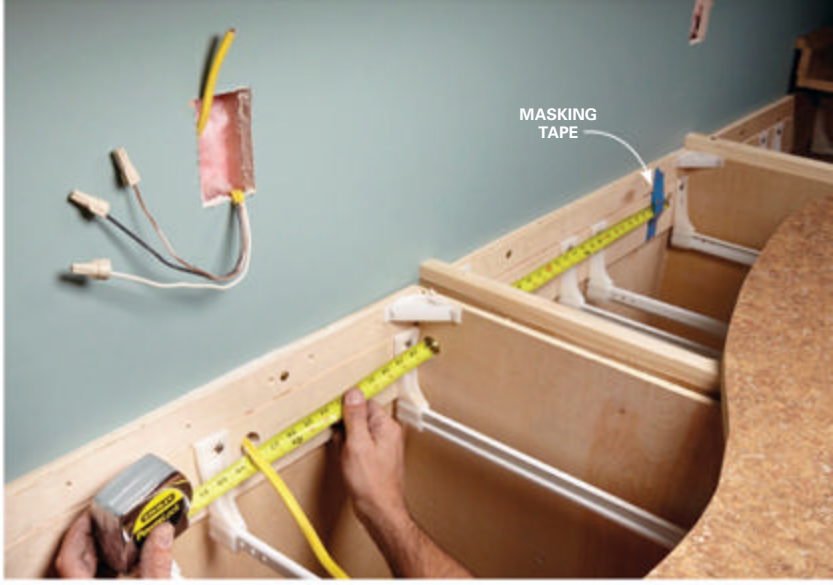
Drill the holes and fish the new cable

Empty the cabinets, and pull out the drawers to get better access. Lying on your back halfway inside a cabinet is not the most comfortable position, so throw down a couple of couch cushions before you get started. And be sure to wear eye protection. Drill a 1-in. hole for the new cable in the cabinet—near the top (**Photo 3**). Don't let the bit travel too far into the wall cavity, or the insulation may twist up like cotton candy on a stick and make it difficult to pull the bit back out. Drill through the sides of the cabinet near the back for the conduit to pass through.

Measure the distance the new cable will travel both horizontally and vertically, and then add several feet before cutting it—it's better to throw out a few feet of cable than end up short. Shove one end of the cable through the hole up toward the box hole (**Photo 4**). It doesn't matter if you start at the new or the existing outlet side. Our expert puts a slight bend on the end of the cable so it hugs the back of the drywall. This will help keep it from getting hung up on insulation.

Install the conduit

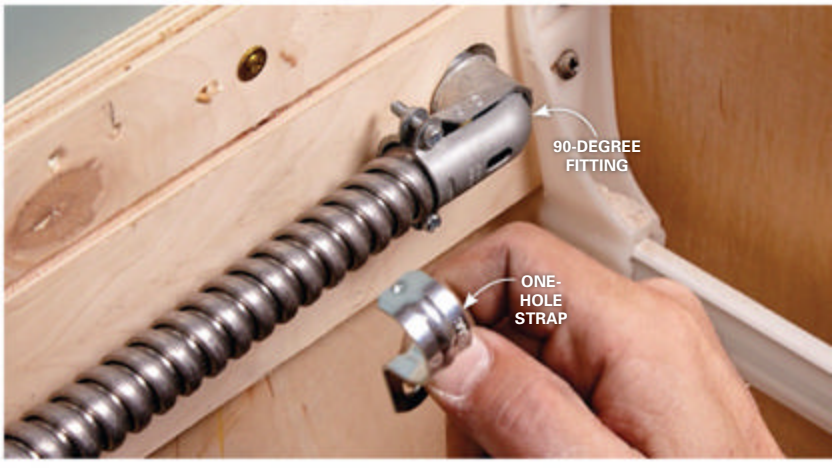
Measure the length of the flexible conduit by sliding a tape measure through the holes in the side of the cabinet. Have a buddy hold the end of the tape in the hole or secure it with masking tape (**Photo 5**).



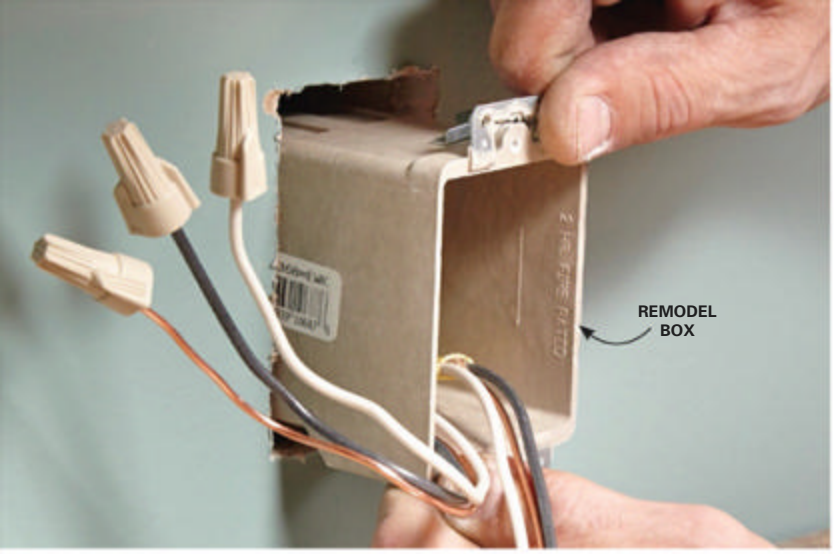
5 MEASURE FOR THE CONDUIT LENGTH
Stick your tape measure through the conduit holes and secure it in the hole in the wall. Have a helper hold the end of the tape, or secure it with masking tape.



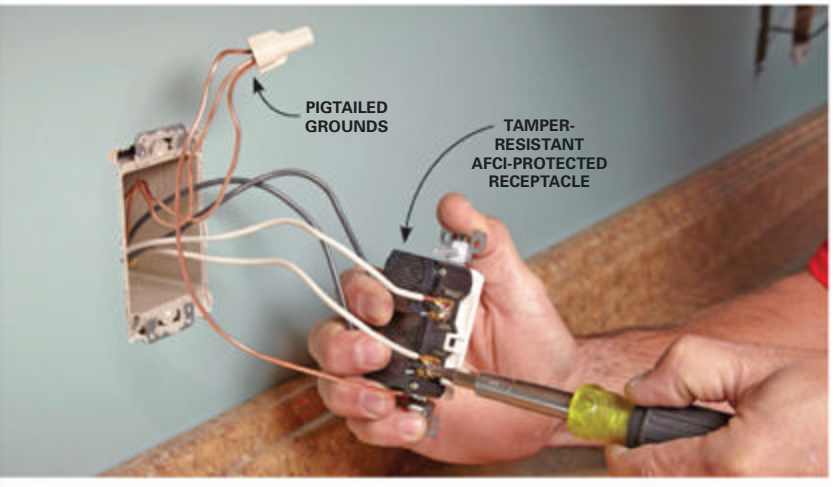
6 SLIDE THE CONDUIT INTO PLACE
Feed the new cable through the conduit, and then push the conduit through the 1-in. holes drilled into the sides of the cabinet.



7 SECURE THE CONDUIT
Hold the conduit in place with straps. Place straps near the 90-degree fittings and one more in the middle if the conduit travels more than halfway across the length of the cabinet.



8 INSTALL THE NEW BOXES
Cut the sheathing off the cable before pulling the wires through the remodel boxes. Slide the boxes into the holes and fasten them to the drywall.



9 WIRE THE RECEPTACLES
Install a tamper-resistant AFCI receptacle at the source outlet as shown in Figure A. The outlets downstream can be standard tamper-resistant receptacles.

DUAL-FUNCTION BREAKERS



A ground fault occurs when electricity travels outside its intended path (wires), and seeks the shortest route to the ground (you). Water is often the cause of a ground fault. That's why, for many years, kitchens, baths and outdoor outlets required GFCI protection, which shuts down the power before injuries occur.

An arc fault occurs when electricity jumps from its proper conductor to an unintentional conductor. Common causes are pinched wires, frayed or cracked wire insulation, and wires damaged by screws, nails or staples. An arc fault can cause a fire, which is why AFCI protection has recently been mandated by the new electrical code for most of the house.

Until recently, the only way to achieve both GFCI and AFCI protection on the same circuit would be to install one form of protection in the panel and the other in the first available receptacle. Now there are dual-function breakers available that offer both types of protection. The 20-amp breaker shown here costs $50 at home centers. Look for dual-function outlets in the near future.

Cut the conduit to length and attach a bushing or fitting to the side you plan to push the wire through. Bushings and fittings protect the cable from getting damaged on the sharp edges of the conduit. Our expert likes the 90-degree fitting because it results in a nice "finished" look with no cable exposed. A standard bushing will result in a small section of exposed cable at the ends, but that's acceptable.

Push the cable through the conduit so it sticks out a few inches on the other side, and then slide the conduit through the holes in the side of the cabinets (**Photo 6**). Once the conduit is through, install the bushing/fitting on the other end of the conduit, and pull the cable the rest of the way through the conduit.

Push the cable up through the second hole in the wall the same way you did the first, and then secure both sides of the conduit with straps near the hole (**Photo 7**). If the conduit travels more than halfway across the length of the cabinet, add another strap halfway between the end of the conduit and the hole in the cabinet.

Install the new boxes

It's easier to remove the cable sheathing before installing the new "old work" boxes, but make sure to leave enough on the cable so about an inch of sheathing pokes into the box. Once the sheathing is removed, pull the wires into the box, slide it into place and secure it (**Photo 8**).

There are several kinds of "old work" boxes, sometimes called "remodel boxes." "Old work" boxes don't get nailed to a stud but instead are secured with wings that clamp onto the drywall as a screw is turned. The type shown here is made from sturdy fiberglass and is available at most home centers.

In this wiring scenario, five individual 12-gauge wires are occupying the source box (all grounds count as one), so the 18-cu.-in. box shown here is large enough to handle all the wires and receptacle without crowding. You may need a larger box if there are six or more wires.

Wire the new receptacles

All outlets in a kitchen require AFCI and GFCI protection. In this example, we're working with a kitchen circuit that already has GFCI protection at some point upstream, which means that we only need to install a receptacle that has AFCI protection (for more details, see "Dual-Function Breakers,"



Time travel at the speed of a 1935 Speedster?

The 1930s brought unprecedented innovation in machine-age technology and materials. Industrial designers from the auto industry translated the principals of aerodynamics and streamlining into everyday objects like radios and toasters. It was also a decade when an unequaled variety of watch cases and movements came into being. In lieu of hands to tell time, one such complication, called a jumping mechanism, utilized numerals on a disc viewed through a window. With its striking resemblance to the dashboard gauges and radio dials of the decade, the jump hour watch was indeed "in tune" with the times!

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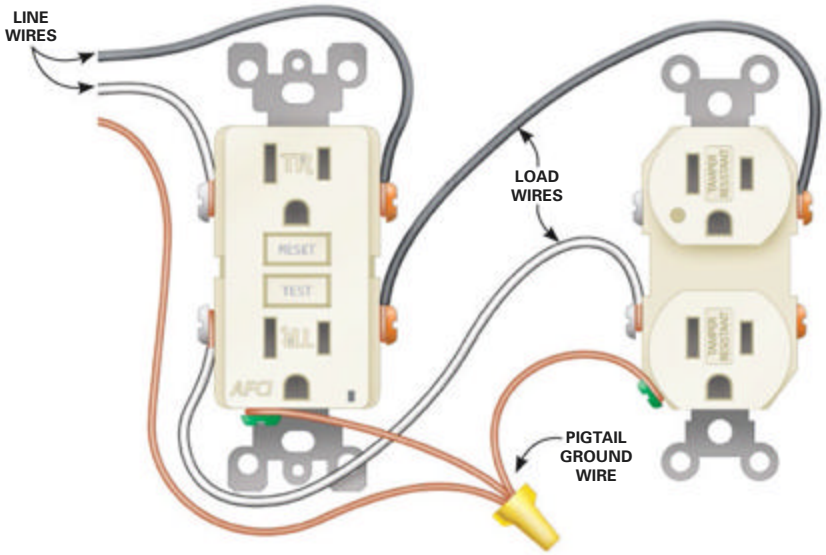


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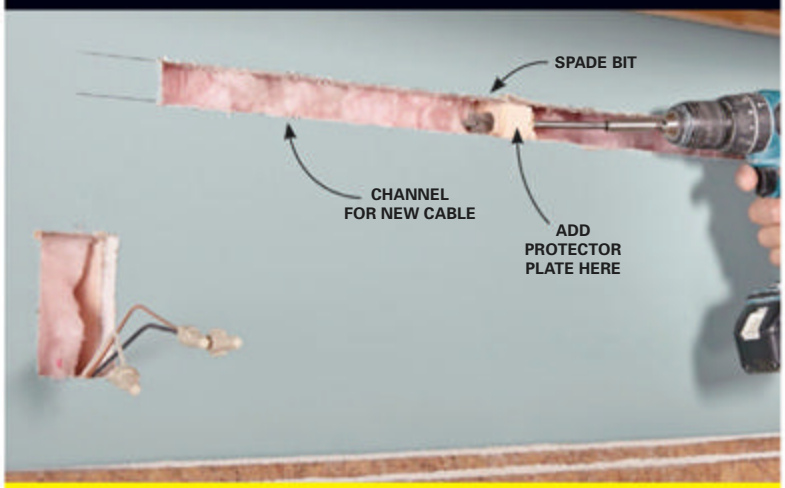
Figure B Wiring diagram for AFCI receptacle



p. 40). One properly wired AFCI outlet will protect all the other 20-amp outlets downstream. Virtually all newly installed receptacles need to be tamper resistant, so look for the "TR" before you buy.

All the line (incoming) and load (outgoing) wires need to be in their proper places (**Figure B**). If you've wired receptacles before, you may have used "pigtails" to connect them. That's where the hot, neutral and ground wires run continuously with small pigtail wires pulled off and connected to each receptacle. Using pigtails is a great way to ensure that if one receptacle goes bad, the rest downstream stay operational. But when wiring GFCI and AFCI receptacles, only the ground wires can be hooked up with pigtails; otherwise the outlets downstream will not be protected (**Photo 9**).

PLANNING TO TILE?



If you plan to tile your backsplash, adding outlets is even easier than we show in Photos 1 – 9. Just run the new cable through a channel in the drywall. A channel is easier because you don't have to empty out the cabinets or mess around with conduit, and the wall can be quickly patched. Make the channel with a jab saw. Cut it a bit higher than the boxes so there's room to bend the cable down into the hole. Install a steel nail plate to protect the cable from future nails or screws.



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FAST FURNITURE FIXES

Easy repairs for everyday furniture

by Tom Caspar
editors@thefamilyhandyman.com

The creaking sound you hear each time you sit on that old kitchen chair is not a good sign. It has loose joints, and every time you sit on it, you're wearing down and further loosening them. Someday it's going to fall apart.

One of these tips will save that chair—and many other pieces of your favorite furniture, too! But keep in mind that these are fast, easy, practical fixes. They are not the best repairs for treasured heirlooms or valuable antiques.





You don't need a workshop to make these repairs—a few simple tools and a sturdy table will do. And you don't need any special skills. If you know the most basic stuff—how to cut plywood and drive screws—you can do it!



ADD BRACES

Chair braces are an easy fix for a wobbly chair. They're better looking and much stiffer than L-brackets (see "Add Metal Braces," p. 51). Most hardware stores carry chair braces in finishes like chrome, brass or bronze ($5 for a set of four). To avoid splitting the wood, be sure to drill 1/8-in. pilot holes before driving in the screws.

FIX A WOBBLY TABLE

If you've got a table that rocks on an uneven floor, you've probably tried wedging something under the short leg. Doesn't last, does it? Here's a better way: Use washers and nail-on glides.

First, drill holes for the nails with a 1/16-in. bit and install the glides. Then set the table in place and slip washers under the low leg until the table is steady. When you've determined how many washers are needed, pull off the glide and reinstall it along with the washers.





RESCUE A DRAWER

Drawer fronts that are just nailed or stapled to the drawer box often come loose or even fall off completely. You could simply pound the parts back together, but that kind of fix won't last long. For a repair that's stronger than the original construction, add a backer to the drawer front.

Make the backer from 3/4-in. plywood and cut it to fit tight inside the drawer. Using a spade bit, drill 3/4-in.-diameter holes in the plywood so you can access the screws that hold the drawer's handle. Fasten the backer to the inside front of the drawer, then screw the drawer sides to the ends of the backer.

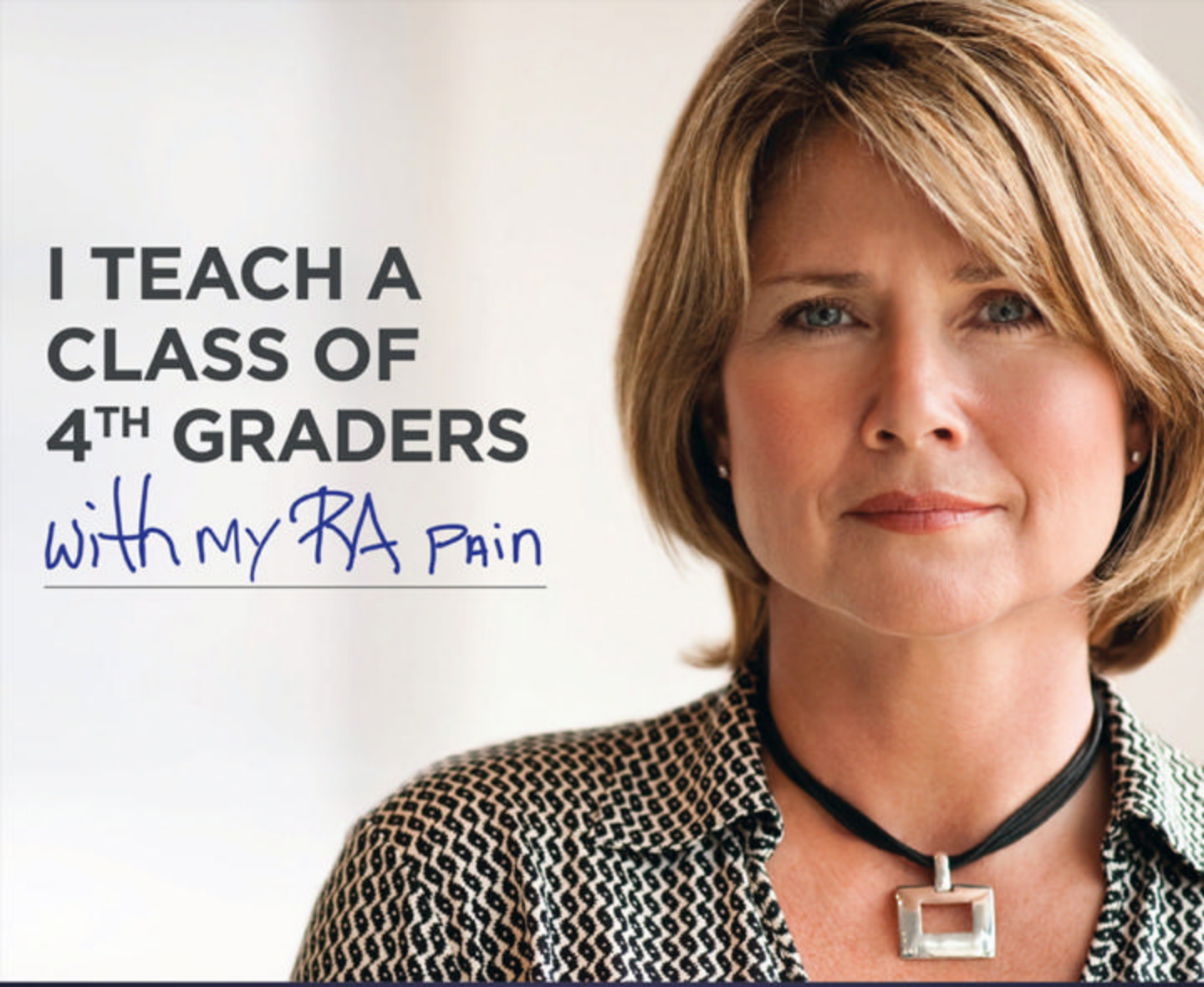


SUPPORT SAGGING SHELVES

If your shelves sag, sometimes you can simply flip them over—but eventually they'll droop again. Here's a permanent solution: Add supports that fit tight between the shelves.

Pine stair tread, which has a rounded front edge, is perfect for this. It's available at all home centers ($10 for 3 ft.). Many stores will cut it to length for you. You can paint or stain the supports to match the shelves, of course. But if the shelves hold books, consider staining them a color similar to your books. You'll be surprised at how well they blend in.

ART DIRECTION **VERN JOHNSON** • PHOTOGRAPHY **GARY SUNDERMEYER**



IT'S NOT OK TO JUST GET BY WITH RA PAIN.

Nobody chooses to have RA, but you do have control over how you live your life with it. If you feel like you're just getting by, talk to your doctor. But keep in mind that patients and rheumatologists often think about RA in different ways. Rethinking how you have the conversation could make a difference in what your doctor recommends.

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HIDE SCRATCHES WITH WAX

To revive a finish, rub colored paste wax over the entire surface and buff. This isn't a perfect fix; heavy scratches or dents will still be visible. But light scratches and wear will almost disappear.

For the best camouflage, pick a color that's slightly darker than the finish. You can find Minwax or Briwax colored paste wax at some paint stores or order it online ($10 to $20 for 16 oz.).



SAVE IT WITH SCREWS

When ready-to-assemble (RTA) particleboard furniture breaks—by being pushed across the floor, for example—the original knockdown fasteners often pull out of the wood and can't be replaced. The solution is to bypass them completely and screw the piece together from the outside.

Ordinary screws won't hold in particleboard, however. You need 2-1/2-in. to 3-in. screws with coarse threads and large, washer-style heads. (Large heads prevent the screws from being pulled through the particleboard.) Many home centers carry "cabinet installation screws" that are perfect for the job. Be sure to drill a pilot hole first, even if the screws have self-tapping points. You can also buy colored self-stick caps to cover the screw heads.



INJECT EPOXY INTO LOOSE JOINTS

When one or two joints loosen on a chair but you can't get the rest of them apart, here's an advanced repair technique to try: Inject epoxy into the loose joints using a syringe.

Once mixed, most epoxy is too thick to push through a syringe. However, an epoxy used for fiberglass boat repair (like the one shown here) has just the right consistency. To inject the glue, drill 1/8-in. holes in an inconspicuous place in line with the dowels. Aim for the cavity behind each dowel. Insert the syringe into the hole, then inject the epoxy until it runs out of the joint. Push the joint together, then wipe off the excess epoxy.

West System 101-TS packets are convenient for storing and dispensing epoxy. They're like ketchup packages—you just tear off the top and squeeze. They're available online (one source is westmarine.com), but at $25 for six packets, this epoxy is more expensive than the hardware store variety. Plastic syringes are available at many pharmacies and online for less than $2 apiece.



FILL STRIPPED-OUT SCREW HOLES

Wooden drawer knobs tend to strip out and then come loose or even pull off. Using a fatter screw or shoving matchsticks into the hole might work, but here's a sure fix: Fill the hole with epoxy putty, then drill a new hole. Epoxy putty is available at home centers and hardware stores ($6 for a 2-oz. roll).

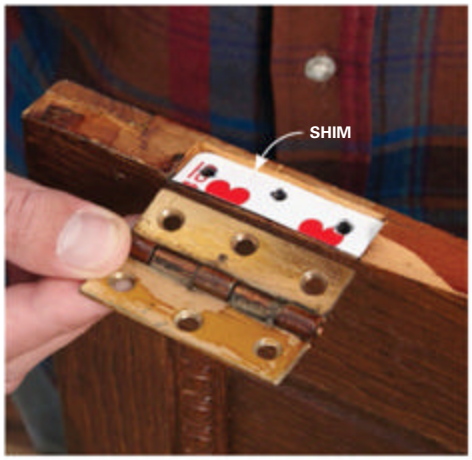
Epoxy putty is easy to use. You just cut off the amount you want, knead the piece until the inner and outer layers blend together, then roll it between your fingers to form a thin string. Push the string of putty into the hole with a screwdriver. Then scrape off the excess before it hardens.



STRENGTHEN READY-TO-ASSEMBLE FURNITURE

New furniture that's put together with bolts and nuts often loosens up with use. If retightening the bolts every now and then seems like too much bother, you can take the piece apart and strengthen it with epoxy.

Most RTA furniture uses loose-fitting dowels to align each part. Spread epoxy inside the dowel holes and on the dowels themselves when you reassemble the piece. (If the dowels fit nice and tight, use yellow glue instead—it's more convenient.) Don't bother spreading glue on the ends of each part. They usually butt against a finished surface, and no glue will stick to a finish for very long.



SHIM A HINGE

When a door won't close or won't align with a catch, placing a shim behind one of its hinges might solve the problem. The shim will kick out the upper or lower half of the door, depending on which hinge you choose.

Make the shim from one or more playing cards. Remove the hinge, then cut the cards to fit into the hinge's recess. Place each piece in the recess and punch screw holes in it using an awl or a small Phillips screwdriver. Remount the hinge with the original screws.

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EPOXY A SLOPPY JOINT

When parts don't fit tightly, epoxy is the answer. Other woodworking glues—yellow, white or polyurethane—require a snug fit. The gap between parts can't exceed the thickness of a piece of paper. Epoxy, on the other hand, bonds across a gap of any size.

Epoxy won't stick well to old glue, so remove as much of the old glue as you can with a file or coarse sandpaper. Most epoxies must be used within five minutes of mixing, but you can buy a slower-setting epoxy if you need more time. Devcon 2-Ton Epoxy gives you a leisurely 30 minutes to assemble parts and is available at many hardware stores.

ADD METAL BRACES



If appearance doesn't matter, screwing a brace or T-plate onto a piece of furniture is often the quickest way to fix it. Adding metal may not make the piece totally sound, but at least it won't come apart.

3 classic tricks

People who repair furniture for a living have all kinds of simple tricks up their sleeve. Here are a few that anybody can do at home:

- Lubricate a sticking drawer with canning wax, which is made from paraffin. Paraffin works much better than candle wax.
- When you're gluing a splinter or chip, use masking tape to hold it in place. A clamp isn't necessary.
- Use steam to raise a dent. Place a wet towel on the dent, then press the pointed end of a hot iron onto the towel, right above the dent, for 10 seconds or so. Two or three applications may be necessary.

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Wi-Fi thermostats

Are they right for you?



A Wi-Fi thermostat connects to your home's wireless Internet service and lets you remotely check and change the temperature in your home from an app on your smartphone or tablet. When Wi-Fi thermostats first came out, the buyers were mainly snowbirds who wanted an alert if their furnace conked out while they were down south. That's not the case anymore. In fact, Wi-Fi thermostats are quickly becoming standard equipment for new homes. If you're considering upgrading your thermostat to a high-tech Wi-Fi version, here's what you need to know.

ART DIRECTION **MARCIA ROEPKE** • PHOTOGRAPHY **TOM FENENGA**

6 reasons you might want to get a Wi-Fi thermostat

Travel

If you live in a cold climate and travel, you should definitely get a Wi-Fi thermostat to keep tabs on your furnace when you're away. In cold weather, a furnace breakdown can endanger pets and plants and lead to frozen pipes and catastrophic water damage.

Easy programming

Setback thermostats save energy but are a pain to program. If programming your current setback thermostat drives you nuts, you'll like the ease of programming a Wi-Fi unit. Just download the app and enter the temps and times on your phone or tablet.

No need to reprogram when your schedule changes

If you have a variable schedule, a typical setback thermostat won't adjust to your changes. But a learning Wi-Fi thermostat will. It detects when you're home and away, learns your schedule and calculates a setback scheme to match your routine. Some learning thermostats also offer a "geofence" feature that tracks the location of your smartphone and operates your setback settings based on when you enter or leave a geographic radius around your home. So, for example, it can crank up the heat when you're returning from a trip and are a few miles from home.

Change the temp from anywhere

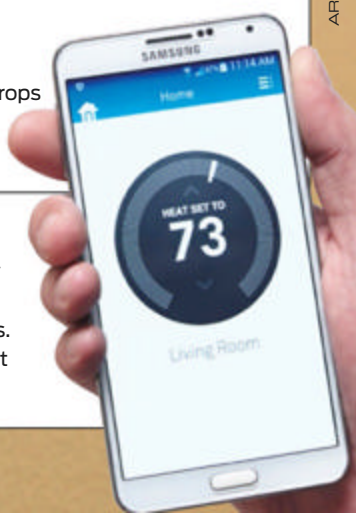
Feeling too hot or cold but don't want to get out of bed or your comfy lounger to adjust the temp? Just reach for your smart device, pull up the app and knock the temp up or down a few degrees. You can also warm up the house just before you arrive there—Wi-Fi thermostats offer the convenience of adjusting temps from wherever you are.

Monitor your HVAC system

Some Wi-Fi thermostats monitor the efficiency of your heating/cooling system and alert you if the efficiency drops because of a dirty air filter, clogged evaporator or condenser coils, low refrigerant charge, or other problem.

They're cool!

You can get units that display your digital photos, play your tunes, change color to match your walls, display the outside temperature or work with multiple sensors. If any of these features sound good, read on to find out if a Wi-Fi thermostat will work in your home.



The hottest Wi-Fi thermostats

There are dozens on the market ranging in cost from $110 to $300. You'll find some at home centers, but begin your shopping online to get a full picture of what's available.

ECOBEE

The ecobee3 thermostat solves the No. 1 consumer complaint—that a room or level is always too hot or cold. The unit comes with a separate wireless sensor to install on that troublesome level or cold room. The sensor communicates with the main thermostat and adjusts heating or cooling to maintain a comfortable setting near the remote sensor. The unit also monitors system performance and alerts you if the furnace or A/C isn't keeping up with the demand. ($250)





REMOTE SENSOR



VENSTAR COLORTOUCH

The full-color touchscreen lets you match the screen color to your wall. Or, insert an SD card with your personal photos and turn the display into a digital photo frame. Add a duct temp sensor (that must be installed by a pro) and the unit alerts you if your heating system isn't performing at maximum efficiency. (T7800; $220)

IRIS COMFORT & CONTROL KIT

The main advantage of the Iris system is that it includes a controller that serves as the heart of a home automation system. So you can add door sensors, keypads, smoke detectors, a siren, a wireless security camera and plug-in receptacles and control all of them, along with the thermostat, from your phone or tablet. ($180 at Lowe's)





CONTROLLER



SENSI

If you're looking for a basic, well-built Wi-Fi thermostat, this is one of the better buys. Its best feature, besides its low price, is the ease of programming via the app. It doesn't have any bells or whistles; it's just a solid Wi-Fi thermostat. ($140)



NEST

If you have a variable routine, this learning thermostat is a good choice. However, it must be mounted in a high-traffic area so it can detect your movement. If your present thermostat is in a rarely used dining room or formal living room, you'll have to move the wiring. ($250)



HONEYWELL RTH9590WF

The coolest thing about this unit is that it works with voice recognition. Just speak your commands to the thermostat and it'll raise or lower the temperature. Or use the app and control it from your smart device. ($290)

Rick Muscoplat
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DIY install?

Professional thermostat installation runs about $75 if you combine the installation with a regular seasonal checkup. We think that's a bargain. But if you feel comfortable wiring it yourself, you can save the money. Just make sure you shut off the power and double-check your wiring to be sure wires don't touch at the terminals. If you're not careful, you can easily burn up a transformer or blow the circuit board's main fuse. In that case, the service call will cost more than what you saved by installing it yourself.

Three things to check

Test your Wi-Fi signal

You must have a strong Wi-Fi signal at the thermostat location. Stand next to your existing thermostat and stream a video on your smartphone or tablet. If it streams smoothly, your Wi-Fi signal is adequate for a thermostat.

Check the wiring

Turn off power to the furnace and A/C and pop the thermostat off the base plate. If you find two thick wires, you probably have 220-volt electric heat, and a Wi-Fi thermostat won't work. If you have skinny 18-gauge wires, you have a low-voltage system, and it'll probably work with a Wi-Fi thermostat. Next, look for a wire attached to the "C" terminal. If you find it, any Wi-Fi thermostat will work. If not, you'll have to buy a "No C wire required" thermostat or install a wiring adapter (see "Wiring Issues and Solutions").

And, if your existing thermostat displays the outside temperature or allows you to adjust the settings on your humidifier, it's probably a digital unit, and an analog Wi-Fi unit won't work without professional rewiring.

Determine the needs of your heating and cooling system

You'll need to know what type of system is in your home and how many stages of heating and cooling it has so you can buy a thermostat to match. If you don't know the specs on yours, find the unit's model number (usually on a plate inside the cover panel) and look for the specs online, or call the installer and ask.

Wiring issues & solutions

A common ("C") wire provides a return electrical path (like a neutral in a 110-volt electrical system) so the thermostat can get power 24/7. If you don't have a "C" wire at the thermostat, you have two options: Buy a Wi-Fi thermostat that doesn't require one (it'll say "No C wire required" in the specs), or install a four-to-five wiring adapter. The "No C wire" style works well in most applications. But if you don't run the heat or A/C often, the batteries may wear down quickly.

If the main circuit board on your furnace or A/C has a "C" terminal, install a four-to-five wiring adapter to get 24-hour power to the new thermostat. One choice is the Add-a-Wire, No. ACC-0410, $22 at supplyhouse.com.



DECK REVIVAL TIPS

GO TO THE PRO!
THE FAMILY Handyman

A fresh finish makes weathered wood look like new



Remember how great your deck looked when it was new? Well, you can restore that look with a new finish. The basic process is simple: Remove the old finish with a chemical stripper, wash the wood with a cleaner (often called a "brightener") and apply a new finish, which may be a stain, sealer or waterproofer. You'll spend at least eight hours on this project, spread over a couple days. Here are some tips for faster, better results.

Make repairs first

If you have cracked or rotted deck boards or railings, replace them before you strip the deck. Putting new wood through the same stripping, cleaning and staining process as the old wood will produce a better match when the job is done. Even you may not be able to tell the new wood from the old.

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ART DIRECTION **VERN JOHNSON** • PHOTOGRAPHY **HSP**

Save time with a pressure washer

To prep a deck for a fresh coat of stain, you'll have to clean it and strip away the old stain. You can get great results with a stiff brush and elbow grease, but a gas or electric pressure washer will save you hours of labor. Most pressure washers have a tank or intake tube that will add stripper or cleaner to the water as you spray. Pressure washer rental for a half day will cost you about $50.

Keep in mind that a pressure washer can damage wood. Start gently in an inconspicuous area, at a setting no higher than 1,000 psi, and hold the wand at least 12 in. from the wood. Increase the pressure or hold the wand closer if needed, but check for gouging and "fuzz" before you move on to the rest of the deck.



Stain railings first

Work from the top down, starting with the rail, followed by balusters and posts. Rollers and foam paint applicators are great tools for applying stain fast. But also keep a paintbrush handy; you'll need it to smooth out runs and drips. If you drip onto the deck (you will!), immediately brush the drips to avoid spotting.

Protect plants

Some deck cleaners and strippers are formulated to be harmless to plants. But refinishing pros tell us that these products are often less effective than stronger cleaners. And since protecting plants is quick and easy, there's no need to avoid the most effective products. Just give nearby plants a good soaking and then cover them with 2-mil plastic sheeting. On a sunny day, plastic covering can "cook" your plants, so keep the cover-up time to a minimum. Spread the plastic right before you begin to clean, and remove it immediately after.

Scrape before you strip

Stripping off the old finish is the slowest—and most tedious—part of deck refinishing. And since you never know how well a stripper will work until you try it, do a little experiment: Apply some stripper to a small area where the old stain is in fairly good condition. While you're waiting for the stripper to loosen the stain, hit another area with a paint scraper. Don't try to scrape off all the stain; just get most of it off. Then use stripper to remove the remaining stain on the scraped area. You just might find that a combination of light scraping followed by stripper is much faster and easier, especially on areas where the stain is in good shape.



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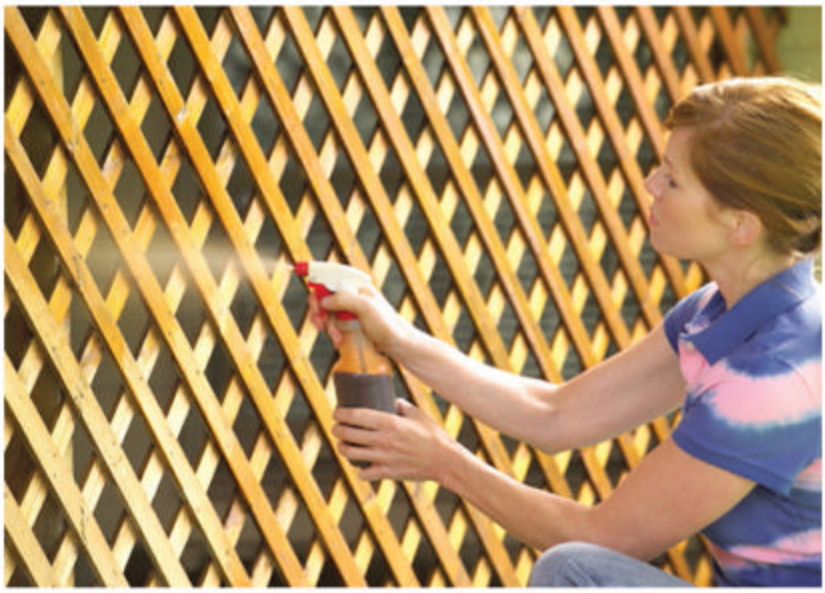


Rinse everything, then wait

Whether you're using a pressure washer or elbow grease, be sure to thoroughly rinse all the wood after you're done stripping off the old stain. That not only washes away any leftover debris but also neutralizes stripper residue. Also rinse down any nearby surfaces that the stripper may have drifted onto.

After the final rinse, wait for the wood to thoroughly dry. Drying times depend on the weather, but expect to wait at least 48 hours. If it rains, you'll have to wait another two days. That's frustrating, but dryness is critical. Most stains won't penetrate or adhere well to damp wood. If you rush the job, the new stain will flake off and you'll have to repeat the whole project.

Exception: Some stains can be applied to damp wood. One example is Thompson's WaterSeal Waterproofing Stain.



Spray stain

If you have lattice or other hard-to-coat surfaces, put some stain in a spray bottle. To avoid runs, set the spray at a wide pattern and apply a light coating; you can always add more stain if the color is too light. Keep a paintbrush handy to smooth out runs.

PRO tips

BY MARK PETERSEN editors@thefamilyhandyman.com

Metal-clad cable



ART DIRECTION ELLEN THOMSON • PHOTOGRAPHY GARY SUNDERMEYER • CONSULTANTS RUNE ERIKSEN, and JOHN WILLIAMSON, MASTER ELECTRICIAN

What is MC cable?

Metal-clad cable comes in several varieties, but the type you'll find at most home centers is three insulated wires (two circuit conductors and a green equipment grounding conductor) protected by a flexible armor usually made from aluminum. MC cable is identified by the gauge of the wire, not the diameter of the armor. The most common sizes are 14 gauge, 12 gauge and 10 gauge.

When electrical wiring needs extra protection, metal-clad (MC) cable is a great solution, and is often required by electrical codes. MC cable is easier to work with than rigid conduit, and it too offers protection from fire, vibration, gnawing pests and physical harm in general. The wiring methods are mostly the same as for nonmetallic-sheathed cable (such as Romex), so we've focused on how to work with the cable itself. These tips aside, you still need to consult your electrical inspector about whether you can, or should, use MC cable on your next project.



MEET THE EXPERT

Rune Eriksen installed miles of MC cable during his 31 years as an electrician at the VA Medical Center in Minneapolis.



METAL BOXES ONLY!

Plastic or fiberglass boxes aren't designed to be used with MC cable. Even if you're able to rig up a connection to a plastic box, you *will* fail the electrical inspection. Make sure the metal box has knockout holes located where you need them, and don't rely on the spurs on the bracket to hold the box in place—add a couple screws as well.



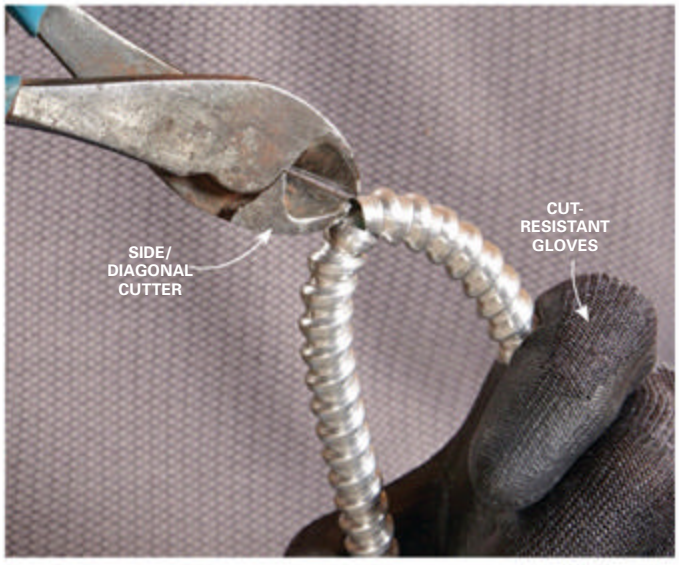
USE FMC FOR MULTIPLE CIRCUITS

Flexible metal conduit (FMC) is commonly called "Greenfield." The main difference between MC cable and FMC is that FMC doesn't have the insulated wires preinstalled; you have to pull them through instead. This requires more work but gives you the option of pulling, and protecting, more than one circuit in the same conduit. It also allows you to add wires in the future, something you can't do with MC cable. FMC is identified by its diameter. The most common sizes are 1/2 in., 3/4 in. and 1 in.



Use 'liquid-tight' outdoors

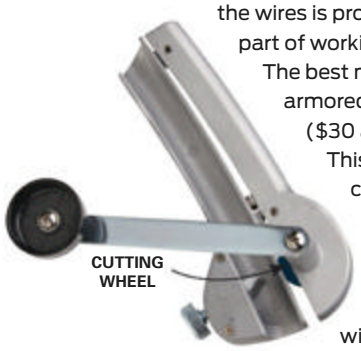
Install liquid-tight flexible conduit wherever the wiring will be subjected to wet conditions. Liquid-tight flexible conduit is water resistant and is available without the wires installed and in short lengths (whips) that come prewired. There are two common types: liquid-tight flexible metal conduit and liquid-tight flexible nonmetallic conduit. Ask your electrical inspector which is approved for your project.



BEND AND CUT

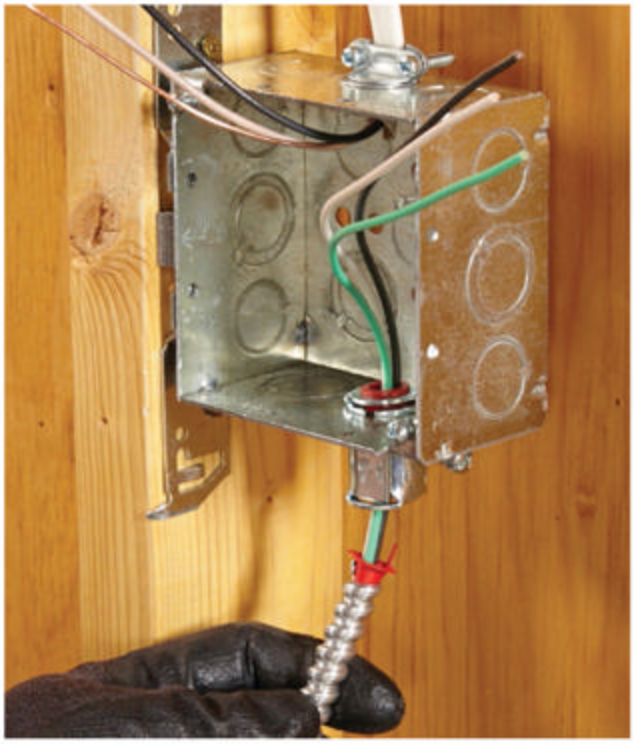
If you just have one or two cuts to make and don't want to invest $30 in a cutting tool, bend the MC cable sharply until the armor pops open, and then use that opening to start the cut with a side/diagonal cutter. You only need to cut through one section in the armor. This method will leave a jagged edge that will need to be trimmed after the armor is separated. The cut ends of MC cable are sharp, so be sure to wear gloves.

A ROTARY CUTTER WORKS BEST



Cutting the armor without damaging the wires is probably the trickiest part of working with MC cable. The best method is to use an armored cable rotary cutter ($30 at home centers). This tool uses a small cutting wheel powered by a hand crank and will cut only through the armor, leaving the wires undamaged every time. Apply firm pressure to the handle, but don't squeeze too hard or the crank will be difficult to turn.

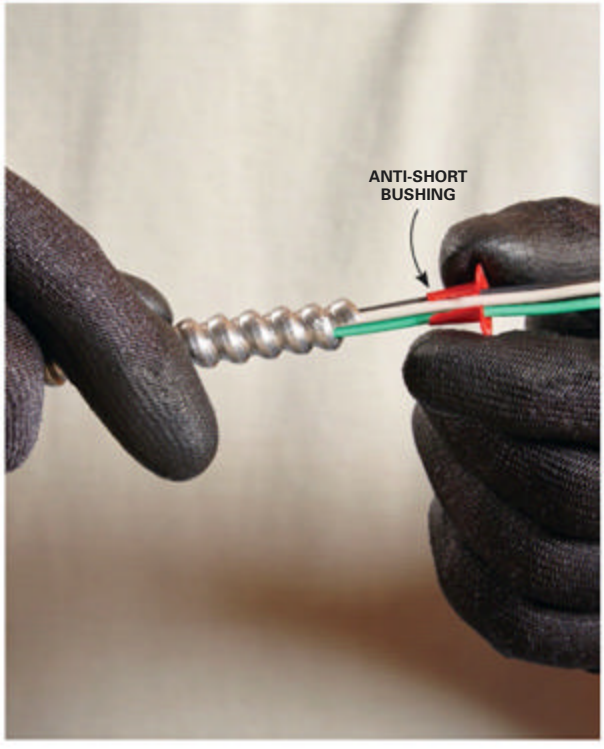




Install the connector into the box first

You *can* attach a connector to MC cable, then join it to the box, but it's easier to mount the connector on the box before feeding the wires through. Connectors like the one shown here (Speed-Lock is one well-known brand) are popular with electricians because the one screw secures both the connector to the box and the MC cable to the connector. There should be a minimum of 6 to 8 in. of exposed wire inside the box.

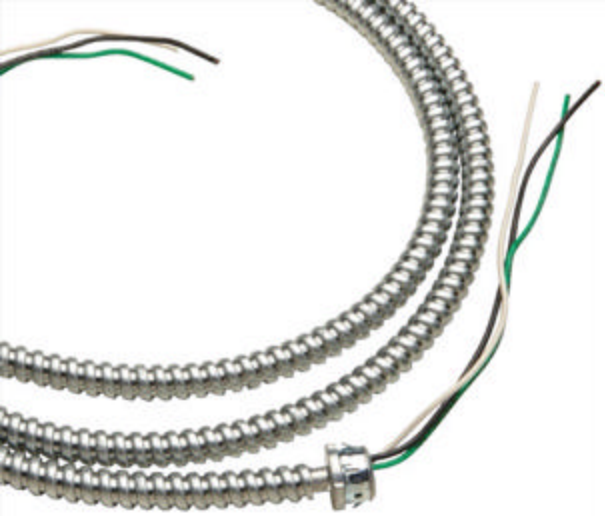




Protect conductors with bushings



Plastic anti-short bushings protect the wires from being damaged by the sharp edge of the armor when the cable gets clamped down into a connector. And even if the connector you're using has its own bushing, make sure to add a bushing like the one shown here. It's a cheap and easy way to achieve an extra level of protection. Some manufacturers supply a bag of anti-short bushings when you buy the cable, or you can buy a pack for a couple bucks.



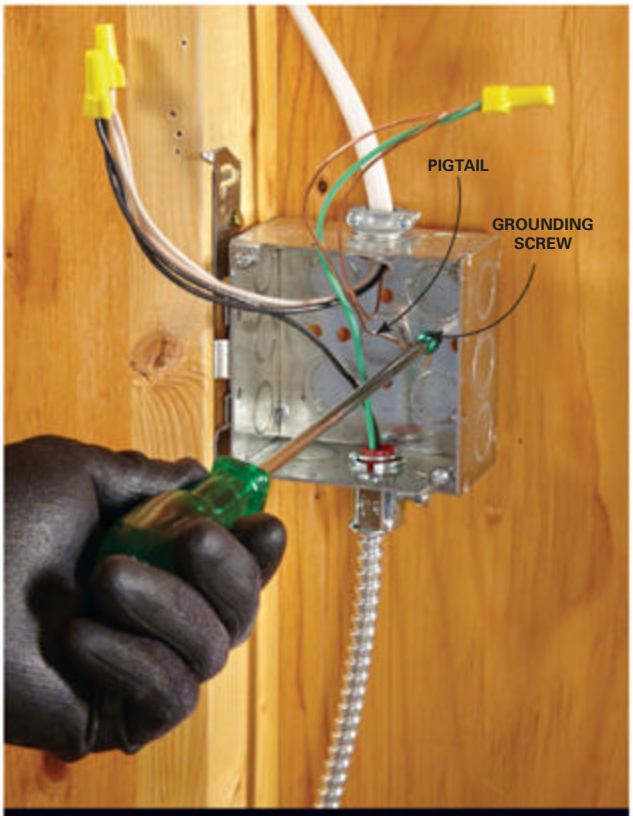
Save time with a whip

Fixture, appliance and air conditioner whips are short sections of cable or flexible conduit that have not only the wires installed, but the connectors as well. Whips cost a lot more per foot but are a huge time-saver because you don't need to mess around with cutting the armor. Whips are usually available in 4-ft., 6-ft. and 8-ft. lengths.



Twist and pull

When removing a section of armor to expose the wires, twist the short end of cable counterclockwise as you pull the cable apart. If it feels like it's taking too much pressure to separate, double-check that the cut went all the way through the armor. Don't pull too hard or the armor could separate farther down the line. That's a problem because damaged armor shouldn't be installed, and you'd have to start over.



Ground the box

Whether it's the first box in a line or the only one on an entire circuit, every metal box needs to be grounded. Grounding a box is as simple as connecting the incoming and outgoing ground wires to a pigtail, and then connecting the pigtail to the box with a grounding screw.



Screw the straps

Single-hole straps make for easy and sturdy supports. Avoid connecting them with nails or you'll risk smashing the cable with a hammer. Install a strap within 12 in. of each box. All subsequent straps need to be within 6 ft. of each other. When you're routing cables, be sure to avoid sharp bends that could damage the cable sheath or the conductors.



Top Ten TIPS

BY MARK PETERSEN editors@thefamilyhandyman.com



ART DIRECTION ELLEN THOMSON • PHOTOGRAPHY GARY SUNDERMEYER UNLESS NOTED

Get smart about smoke alarms

Smoke alarms may be the cheapest, easiest and most effective means for protecting your family and your home from a fire—as long as they're functioning. According to the National Fire Protection Association, three out of four in-home fire deaths occur in homes without a working smoke alarm. We've gathered some great information to help you avoid becoming a tragic statistic. You'll learn where to put your smoke alarms, how to maintain them and when to replace them. We'll also show you some cool new options available.



1 Write down the install date

Smoke alarms should be changed every 10 years. Most manufacturers list the date a smoke alarm was made on the back. That's helpful information if you remember to look for it. Give yourself a proper reminder, and write the date you installed the alarm in big, bold letters on the base plate so you'll notice it every time you change the batteries.

Three things you need to do

- Check smoke alarms once a month.
- Change batteries once a year.
- Replace alarms every 10 years.



2 Protect smoke alarms from dust

Excessive dust and paint overspray can wreak havoc with a smoke alarm's sensors. Before starting that messy remodeling project, temporarily cover or remove any alarm in harm's way. And if you are painting the ceiling, don't paint over the alarm—that will probably destroy it.



3 Connect alarms wirelessly

If a fire triggers an alarm in the basement, will you be able to hear it from your second-story bedroom? Interconnected alarms provide better protection because if one goes off, they all go off, and early detection is key to safely escaping a house fire.

Smoke alarms in new homes are required to be hardwired and interconnected, but now you can get the same protection in your old house with smoke alarms like this one that speak to one another wirelessly. At about $50, they cost more than a standard alarm, but they're a much cheaper option than installing new wires all throughout the house.



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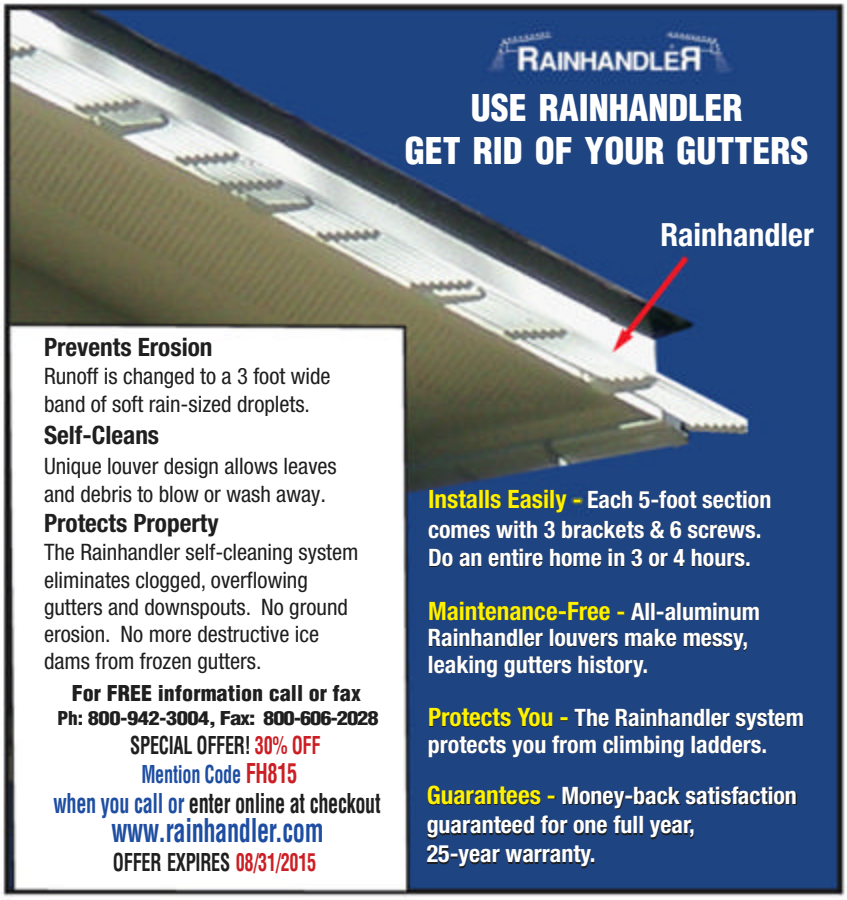
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4 Save the instructions

Not all smoke alarms operate the same. Three chirps every minute may indicate "low batteries" for one unit and "end of life" for another. Save the instruction manual so you won't have to guess what your alarm is trying to tell you. Keep the manual in a place you'll remember. If you don't have a file or drawer for manuals, start one. If you have an unfinished basement, nail one up right next to the alarm itself.

Where to install smoke alarms

- At least one on every level
- Bedrooms
- Outside of bedrooms (hallways, etc.)
- Kitchen (at least 10 ft. away from stove)
- Living rooms
- Basement
- Ceiling near the bottom of stairs leading to the next level

Positioning is critical

- Walls, 4 in. to 12 in. from the ceiling
- Near the peak of a vaulted ceiling (within 4 in. to 3 ft.)
- In accessible areas (for easy battery replacement)
- Not in the garage
- Not in the attic
- Not in the utility/furnace room

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5 Downsize if you prefer

If you don't like the look of smoke alarms, then smaller is better. Smoke alarms don't have to be big to be effective. This little guy from First Alert is called the Atom. It's a fraction of the size but performs just as well as its larger cousins. The Atom costs $25 each or $35 for a pack of two.



6 Install strobe lights for the hearing impaired

People who can't hear an alarm need an alarm they can see. Some strobe alarms include smoke detection ($100 to $120). Others are strobe lights only ($50 to $70) and need to be connected with a compatible smoke alarm.

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7 Keep the sensors clean

Dust can cause a smoke alarm to malfunction. Run a vacuum fitted with a soft brush over them every time you change the batteries, at least once a year.



HSP

8 Buy a compatible replacement

Wiring up a smoke alarm is pretty easy, but connecting it in a harness plug is even easier. When you need to replace your hardwired alarms, take along an old one to the store. Save a bunch of time and buy new alarms that will accept the wiring harness on the old ones. That way all you have to do is plug in the new ones and maybe replace the base. Some new models come with wiring harness plug adapters, which makes matching easier. If your alarms are interconnected, never mix alarms made by different manufacturers.

WHAT'S THE DIFFERENCE?

HARDWIRED
Hardwired smoke alarms operate off a home's electricity, but still rely on batteries as a backup if the power goes out.

BATTERY-OPERATED
These units work on battery power alone. Some newer models have batteries that last 10 years.

INTERCONNECTED
Most hardwired alarms are interconnected, meaning if one goes off they all do. Battery-operated models can now be wirelessly interconnected (see "Connect Alarms Wirelessly" on p. 66).



HSP

9 Hide a hole

Painting or retexturing a ceiling is no fun. If you have a hole from a hanging lamp, or a small water stain, cover it up with a smoke alarm. Who cares if it's not interconnected with the other hardwired alarms? There's no such thing as "too many" smoke alarms.

10 Quiet nuisance alarms

Kitchens are particularly susceptible to "nuisance" alarms. The horn on a typical alarm won't stop sounding until there's no more smoke to detect, which in a kitchen could take a while. Nuisance alarms are one of the main reasons people disable smoke alarms, and that's not a good idea, especially in the kitchen where the majority of fires start. Now there are smoke alarms available that have a "hush" button on them. Pushing it will kill the noise long enough for you to air out the room.

Some sensors are more sensitive than others, even if they're the same model. Before you go buy an alarm with a hush button, try swapping out the one in the kitchen with one from another part of the house.





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BY RICK MUSCOPLAT editors@thefamilyhandyman.com

Installing a handicap ramp

If you have a family member or friend with mobility challenges or you're dealing with one yourself, installing a wheelchair ramp can allow for a safe and independent lifestyle. Here are some basics you should know.

Ramp prices depend on the overall length, the number of landings, the materials (wood or aluminum), and whether you build it yourself or hire a contractor. You can build one yourself for a materials price of about $35 per lin. ft., or hire a ramp contractor to build it for you in a day or two for about $100 per lin. ft.

Prefabricated aluminum sections cost about $100 per lin. ft., and you can assemble the sections yourself. But they take a while to order and ship. Or you can hire a company to design and install an aluminum ramp for about $150 per lin. ft. You can get ramp design advice, contractor referrals, help from community volunteers and even financial assistance from more than 350 nonprofit organizations nationwide. Just search online for "ramp project (your state)" to find them for your location.

We've seen some pretty scary DIY ramps, so we contacted the experts at the Metropolitan Center for Independent Living, publishers of the booklet "How to Build Ramps for Home Accessibility" ($20 for the booklet and DVD from mcil-mn.org/index.php/programs/ramp-project). They referred us to Warren Moe Construction, a ramp contractor in Minneapolis. Warren walked us through the basics of building a wood ramp and let us know the most common DIY ramp-building mistakes. With basic carpentry skills and a miter saw, router, drill, level and framing nailer, you can build your own ramp. Here's the process.



Measure and design

Start by measuring the distance from the threshold to the ground at the most accessible exterior door. Then determine the preliminary ramp length. A gentle 1:20 slope (1 in. of rise requires 20 in. of run length) is best for ease of use but requires a longer, more expensive ramp. If your yard isn't large enough to accommodate that length, add switchbacks and landings or build a ramp with a slightly steeper grade (the steepest ramp slope allowed is 1:12). Follow ramp-building guidelines

MEET THE EXPERT



Warren Moe works with homeowners, accessibility organizations and volunteer groups to make homes more accessible. His company, Warren Moe Construction, builds wheelchair ramps, widens doorways and installs grab bars.

ART DIRECTION MARCIA ROEPKE • PHOTOGRAPHY TOM FENENGA • TECHNICAL ART FRANK ROHRBACH III • CONSULTANT WARREN MOE CONSTRUCTION

Figure A
Landings for turns
Build a 58 x 60-in. landing for all 90-degree turns.

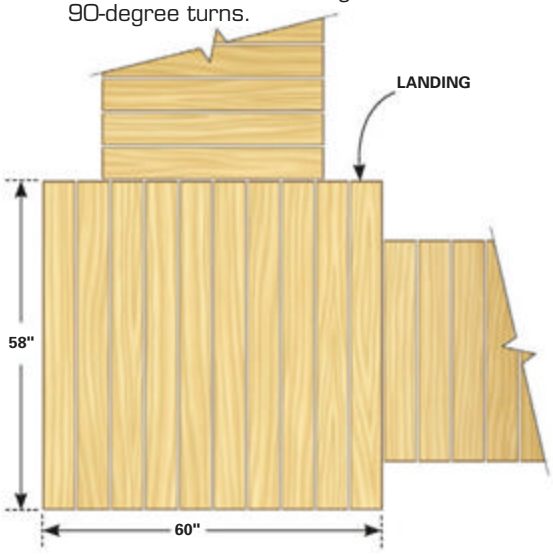
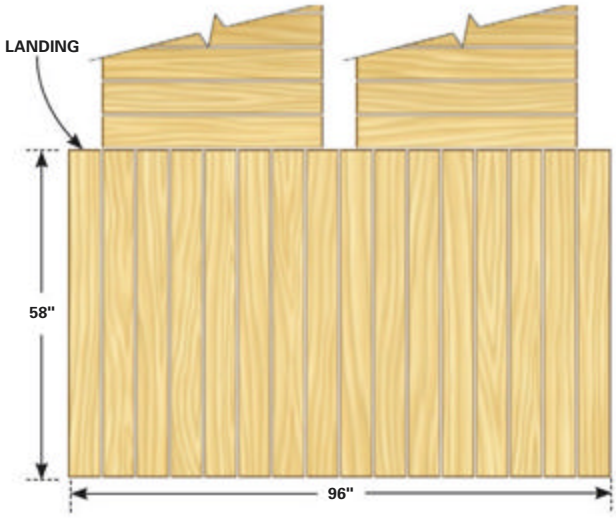


Figure B
Landings for switchbacks
Build a 58 x 96-in. landing for all 180-degree switchback turns.



and adjust the ramp length and slope to account for grade changes in your yard.

Get approvals and permits

Most building codes require a permit and inspection if the ramp is 30 in. or more above the ground. In addition, some locations require frost-proof footings for permanently installed ramps, while others allow you to set the ramp on treated plywood pads if it's for temporary use. Plus, many homeowner associations require design and material preapproval before you can start the project. Check all those requirements and get all your approvals and permits well before any trips to the lumberyard.

Build the ramp in modules

Building the ramp in place with long spans is a common DIY mistake. Long spans are harder to adjust and impossible to reconfigure if the original design proves unworkable. Instead, build individual modules and bolt them together at the vertical supports. Later on, you can disassemble and sell the modules to recoup your investment when the ramp is no longer needed.

Mind the gap

The two most important areas on a ramp are where the upper landing butts up to the door threshold and where the ramp transitions to the ground. The upper landing must be level or within 3/8 in. of the threshold. A larger gap will abruptly stop the wheelchair's front wheels.

CALCULATE SLOPE AND END POINT

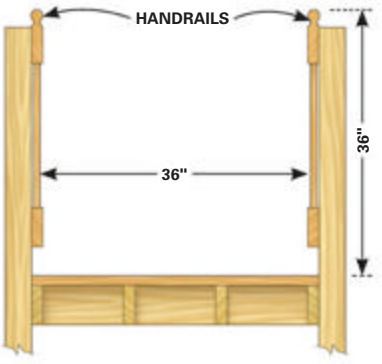
Use the slope formula to calculate the ramp's end point. Multiply the distance from the threshold to the ground by the preferred slope. That'll give you the ending point from the house (not the actual ramp length), if the ramp is built in a straight line. To determine the actual ramp length to calculate a bill of materials, find the square root of the sum of the rise height squared and the distance from the house squared. Then add the lengths of the landings.

The important dimensions

Door landings should be large enough (at least 58 x 60 in.) to allow a wheelchair occupant to open the door and back up without rolling onto the sloped area. Allow extra elbow room (12 to 24 in.) on the handle side for out-swing doors. A 58 x 60-in. landing is adequate for 90-degree turns (**Figure A**), but must be 58 x 96 in. (**Figure B**) for 180-degree switchback turns. If the ramp includes long stretches, include an intermediate level landing as a rest area.

Making the ramp too narrow is also a common DIY mistake. The ramp must have at least 36-in. side-to-side

Figure C
Ramp width and height
Build the ramp width to provide a minimum side-to-side clear space of 36 in. Locate the top of the handrails no more than 36 in. from the ramp floor.



clear space and a maximum 36-in. spacing from the ramp floor to the top of the handrails (**Figure C**).

Before you proceed, draw a detailed sketch of your ramp, showing ramp width, landing size and site location,

Local codes trump our advice

Local building authorities have the final word on all designs and specifications. Don't wait until your ramp is built to discover that it doesn't meet your local codes. Get your plans reviewed by a local building inspector first so you don't have to redo your hard work.

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REPAIR OR REPLACE A CONDENSATE PUMP

In the summer, central air conditioning units remove moisture from the air. And in the winter, condensing gas furnaces generate an enormous amount of wastewater. Plus, if your furnace has a humidifier, it also drains off extra water. All that water has to go somewhere. In newer homes, it goes right into a nearby floor drain.

But many older homes don't have a floor drain next to the furnace. So furnace installers mount a condensate pump right on the furnace and route



1 TEST THE PUMP
Hold a bowl over the pump outlet to direct water into a bucket. Then slowly pour water into the pump reservoir until the pump kicks in. If water shoots from the outlet, the pump is good.



2 CLEAN THE CHECK VALVE
Soak the check valve in warm, soapy water. Then scrub with an old toothbrush. Rinse. Then blow it out with compressed air before testing.



the drain line to a far-off sink or floor drain. If that pump fails, the water overflows the pump and spills onto the floor. That doesn't necessarily mean the pump is bad; the problem could be just algae buildup in the pump's check valve.

So start your diagnosis by unplugging the pump. Disconnect the drain line and empty the water into a bucket. Then remove the check valve and plug in the pump (**Photo 1**). If the pump doesn't work, buy a new one (about $60 from a home center or online HVAC store) and swap out the old one. However, if the pump works, you've got a stuck check valve.

Try cleaning the valve by soaking it in warm, soapy water. Then flush it. Clean out any remaining crud with compressed air and test it (**Photo 2**). If you can't remove all the crud or the valve is still stuck, replace it with a new valve (about $10 from the pump manufacturer's parts department). The furnace or A/C will continue to drain while you're waiting for the new part to arrive, so jury-rig a bucket system (**Photo 3**). Clean any algae buildup from inside the pump with soapy water and a brush before installing the new valve. Then install the new valve and test. To prevent algae clogs, place algae reduction tablets (such as Pan Tablets No. AC-912; $4 at homedepot.com) in the pump reservoir.



3 CATCH THE WATER WHILE YOU WAIT FOR PARTS
Remove the pump and aim the drain tubes into a bucket. Empty often to prevent overflowing. Then reinstall the pump with the new check valve when it arrives.





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It may have already begun.

In San Jose, snipers fired on a substation and took out 17 transformers, disrupting power to Silicon Valley. No arrests were made. Was it a practice run for a widespread attack?

Weather is the other enemy.

Hurricanes, tornadoes, earthquakes, even events like last year's Polar Vortex are all capable of inflicting severe damage, blacking out large parts of the country. And few folks are prepared for the deprivation and lawlessness that often follows.

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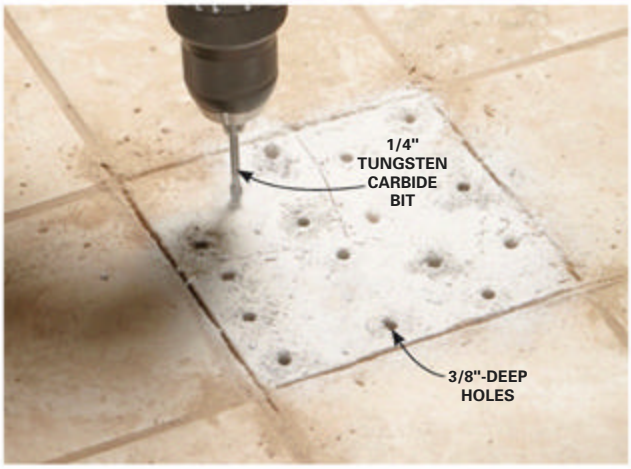
Remove a broken ceramic tile

You can remove a cracked ceramic tile by grinding out the surrounding grout and then smashing it to bits with a hammer. However, the brute force method can also break the bond between neighboring tiles and the tile backer board. Then you have a real mess. Here's a better way.

Start by removing the surrounding grout (**Photo 1**). Next drill holes in the tile with a 1/4-in. tungsten carbide bit (**Photo 2**). The holes loosen the tile's bond to the backer board. Then chisel out the tile (**Photo 3**). Scrape out any remaining thin-set material and install the replacement tile.



1 REMOVE GROUT
Grind out the grout with a hand scraper or an oscillating tool fitted with a grout removal blade.



2 DRILL THE TILE
Drill multiple 3/8-in.-deep holes in the tile using a tile bit. (A hammer drill will really speed this up.) Wear safety glasses.



3 CHISEL OUT THE TILE PIECES
Tap a tile or cold chisel straight into the center of a crack. Then angle the chisel to 45 degrees and chisel toward the edges.



BY RICK MUSCOPLAT editors@thefamilyhandyman.com

Fix rust spots



ART DIRECTION **VERN JOHNSON** • PHOTOGRAPHY **TOM FENENGA**

As long as vehicle body panels are made from steel, they're going to rust. Sure, you can lower your risk by applying paint protection film to chip-prone areas like the front edge of the hood, and by frequently washing off road salt and waxing your vehicle regularly. But even then, you're still going to get rust spots. If you ignore them, they'll spread and turn your sheet metal into Swiss cheese in no time. However, if you deal with rust early, you can stop it from spreading and squeeze a few extra years out of your vehicle.

Rust repair isn't hard, but it is time-consuming (mostly waiting for primer and paint to dry between steps). Plan to spend about $100 on supplies like sandpaper, primer, masking tape and poly sheeting, a tack rag, polishing compound and touch-up paint and clear coat. Choose a calm, overcast day and block out the full day to fix the most common rust spots on the hood and doors. Here are the steps.

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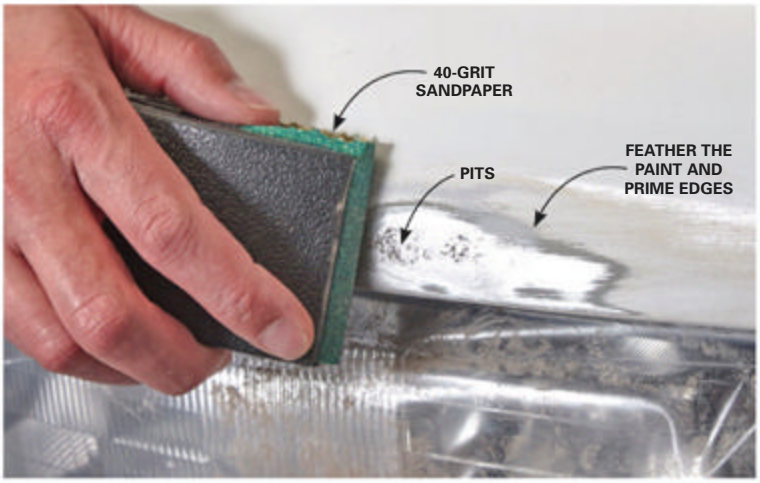
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1 MASK OFF THE REPAIR AREA
Tape the leading edge of poly sheeting a few feet away from the repair so you'll have room to blend the touch-up paint into the good areas.



2 REMOVE THE RUST
Sand through the rust spots, down to bare metal. Then enlarge the sanded area so you'll have space to feather the edges. Switch to 120-grit sandpaper to feather the edges of the repair area. Complete the feathering with 220 grit.



3 CLEAN WITH DETERGENT
Clean the entire unmasked area with a grease-cutting dishwashing detergent, followed by clean rinse water. Let it dry. Then wipe the area one more time with a lint-free cloth to remove any remaining dust or lint.

Buy paint and supplies

You can buy automotive touch-up paint in pints and quarts to use in a spray gun, in aerosol cans, or in roller ball applicators. Even if you know how to use a spray gun, mixing automotive paint with a reducer to match the temperature and humidity conditions can be mighty tricky. We don't recommend it. Instead, buy aerosol cans for larger repairs and roller ball applicators to fix scratches.

In order to buy the perfect color match for your vehicle's factory paint, you'll first need to find the car manufacturer's paint code. It can be in a variety of places on the body, in the engine compartment or trunk, or other places. Use either of these online resources to find instructions on how to locate your paint code: automotivetouchup.com/paint-code.htm or duplicolor.com/appGuide/applicationGuide.pdf.

Most late-model vehicles were painted with base coat/clear coat paint. The base coat contains just the pigment and binding resins—the clear coat is just the gloss. You'll need equal amounts of both. You'll also need an epoxy self-etching primer to bite into the bare metal and a lacquer primer to hold the paint. We used paint, primer and sanding supplies from automotivetouchup.com for this repair. The Dupli-Color brand is available at most retail auto parts stores, car dealers and online retailers. Or, you can buy automotive paint locally from a professional auto body supplier.

Next, buy 40-, 600- and 1,000-grit sandpaper, a sanding block, grease and wax remover, poly sheeting, painter's tape, a tack rag and a microfiber cloth.

Mask the vehicle

Protect the entire vehicle from paint overspray with poly sheeting. If you're painting the hood, spread poly sheeting over the engine and fenders. In door areas, cut poly sheeting to fit the door opening and tape it to the jamb. The final masking must be a foot or two away from the repair area (**Photo 1**).

Sand, feather, and clean

Crack off any blistered paint with a scraper. Then sand the rust using 40-grit sandpaper (**Photo 2**). Then feather the paint edges. Use a tack rag to remove particles from the unmasked area. Then clean the sanded area (**Photo 3**) and apply the paint manufacturer's prep solvent.

If the rust has created pits in the metal (**Photo 2**), you can fill them now with body filler or wait until the epoxy primer dries and apply multiple coats of filler primer.

Prime the surface

Self-etching epoxy primer provides a strong bond to bare metal, so use it as your first coat. Spray two to three medium coats, allowing the recommended wait time listed on the label (usually 15 minutes) between coats. Wait a full hour for the epoxy to dry to the touch (longer if it's humid outside). Sand the epoxy primer with wet 1,000-grit sandpaper. Wash with clear water and let dry. Wipe the dried epoxy primer with a lint-free cloth and apply two to three heavier coats of lacquer filler primer (**Photo 4**), allowing drying time between each coat. Let the lacquer primer dry until it's dry to the touch—at least one hour—before sanding.

Sand drips and sags with 320-grit sandpaper. Then final-sand the entire repair area (**Photo 5**).

Spray the base coat

Holding the spray can about 12 in. away from the surface, spray the repaired area (**Photo 6**). The slower you build the color coat, the better it'll look under the clear coat. Allow the base coat to dry, until it's dry to the touch, at least 60 minutes. Don't sand the base coat (especially metallic colors) unless you've created sags. In that case, sand lightly and then respray the touched-up areas.

Add the clear coat

This is the hardest part because all clear coats run easily and that will ruin the look of your paint job. If you create a run in the clear coat, you'll have to let it dry for at least 48 hours before attempting to fix it with fine-grit sandpaper and polishing compound. Then you'll have to respray the sanded area. So practice spraying on a scrap piece of cardboard to get a feel for the nozzle and the speed of application.

Clean the painted area one last time with a tack rag. Then apply the first layer of clear coat so it looks wet (**Photo 7**).

Let the clear coat dry for several hours before driving the vehicle and at least 48 hours before buffing.

Buff the repair

Using an old cotton T-shirt or microfiber cloth and buffing compound, hand-buff the repaired area. Don't use a polishing machine for this step. Wait at least 30 days before waxing.



4 APPLY EPOXY PRIMER, THEN FILLER PRIMER
Spray the filler primer in heavier coats to cover the entire repair area. Move the can away from the surface slightly and blend it into the surrounding painted area.



5 SAND THE PRIMER
Starting with wet 600-grit sandpaper, smooth the primer and feather the edges. Then switch to wet 1,000-grit sandpaper to final-sand the entire repair, including the blended areas.



6 APPLY THE COLORED BASE COAT
Start at the bottom of the repair and apply the color coat in left-to-right rows, overlapping each pass by about one-third. Build the color slowly into the repair and surrounding areas in two to three coats, allowing about 10 to 15 minutes between coats.



7 SPRAY ON THE CLEAR COAT
Apply several coats of clear coat, allowing the recommended drying time between coats. Gradually work the clear coat into the surrounding painted areas to achieve a smooth blend line.

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What every homeowner MUST know

BY GARY WENTZ editors@thefamilyhandyman.com

PLAN YOUR LANDSCAPE

Planning a pond or patio? A retaining wall or planting bed? Don't just grab a shovel and start digging. Instead, lay down a rope or garden hose to map out the footprint. Stand back, survey the shape and make adjustments. Also check the layout from your kitchen window or a second-floor room. When you're happy with the shape, mark it with spray paint and get to work.



Use a GFCI outdoors

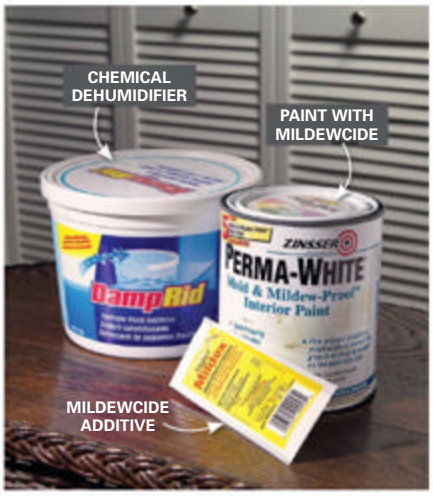
House chores—especially outdoors—often bring water and electricity together. The best way to make those situations safer is to use a GFCI (ground-fault circuit interrupter). Newer homes have GFCI protection in bathroom, kitchen, garage and exterior outlets, but those GFCIs may no longer offer protection after 10 years or so. To be safe, plug your tools into a GFCI extension cord before you venture into the wet grass.



Fight closet mildew

Because they're dark and lack air circulation, closet walls are especially prone to mildew. Here are a few proven solutions:

- Add mildewcide to paint or use paint that already contains mildewcide (check the label).
- Run a dehumidifier in damp rooms.
- Cut closet humidity. Chemical dehumidifiers are nontoxic products that absorb moisture from the air.
- Leave closet doors open or replace solid doors with louvered doors to increase airflow.



ART DIRECTION **MARY SCHWENDER** • PHOTOGRAPHY **HSP**



How to water a new tree

For the first few weeks, you may have to water a new tree every few days depending on the weather. After that, longer (deeper), less frequent watering is much better than shorter (quicker), frequent watering. To help the tree create deep roots to resist drought and wind, encircle it with a soaker hose a few feet out from the trunk and run it at a trickle for an hour. Push a popsicle stick (or your finger) 2 to 3 in. into the ground. If the soil is damp down 3 in., you're giving it enough water. If not, water until the soil is damp but not saturated around the root-ball. Allow the soil's surface to begin to dry out between waterings.

SAVE A SINKING SIDEWALK

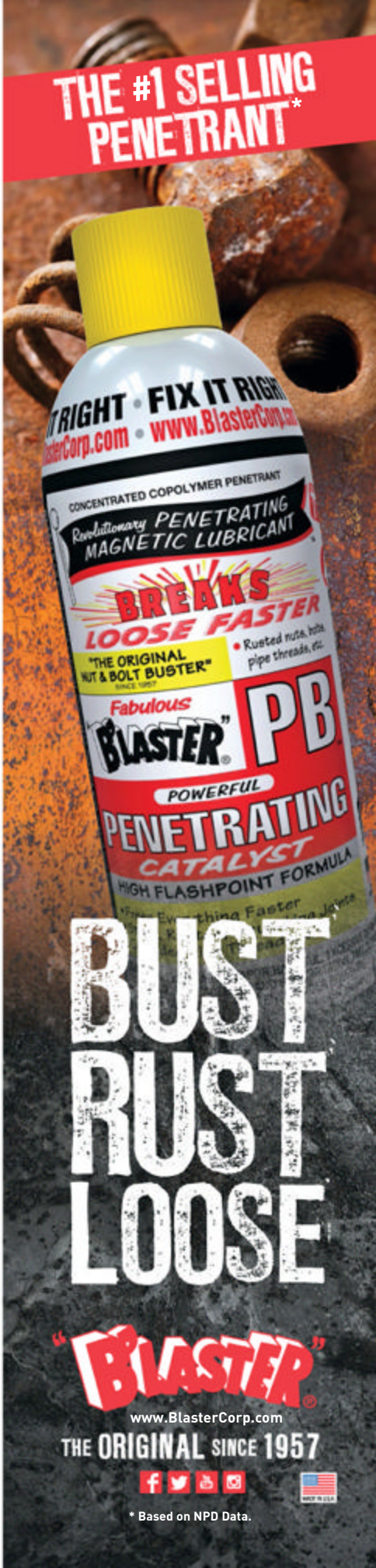
Sinking concrete that's in otherwise good condition can be raised back to its original level by any contractor who has mudjacking equipment. The contractor first drills holes in the concrete, then injects a watery mix of sand and other components called "slurry" or "grout." The components in the slurry vary. The slurry is pumped in under enormous pressure—enough to lift sidewalks, driveways and even sinking steps. To find a contractor, just search online for "mudjacking" and the name of your city. Costs vary a lot, but most jobs are $300 to $700.



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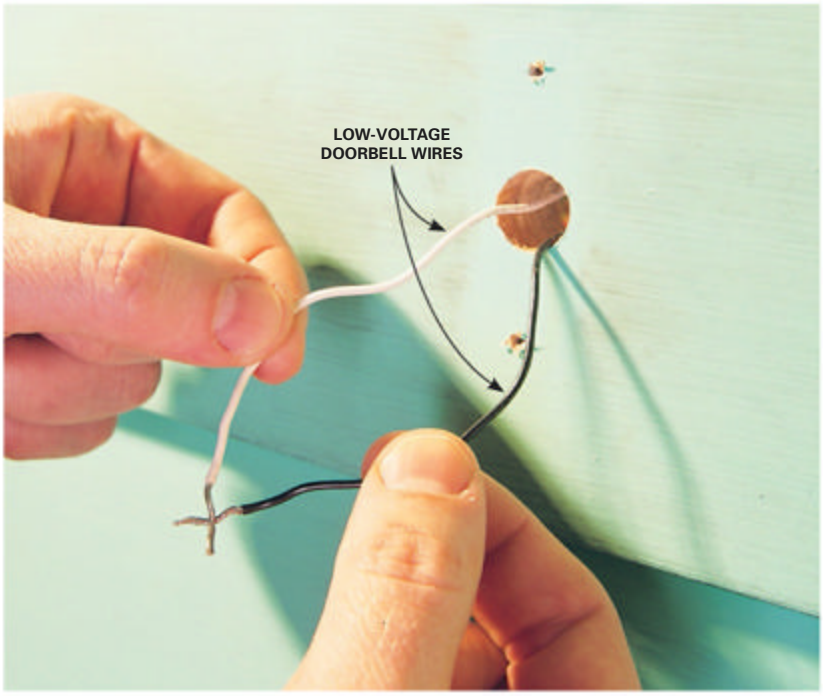
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HOW TO FIX A DEAD DOORBELL

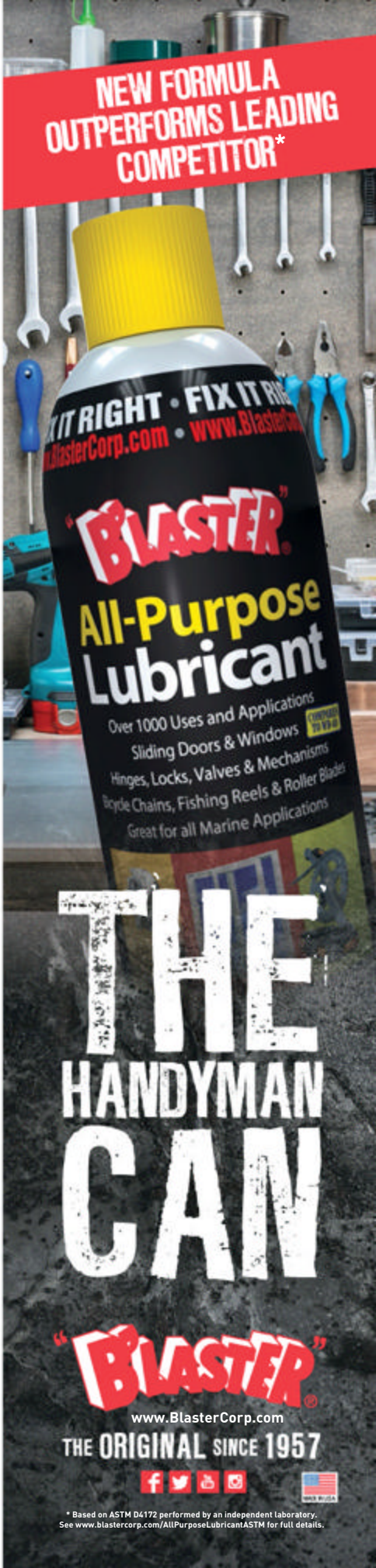
A wireless doorbell is an easy, inexpensive solution: Just mount the button by the front door and the chime anywhere indoors. But before you do that, check your existing doorbell button. The button is the most likely culprit and it's connected to low-voltage wiring, so you don't have to worry about getting shocked. Here's how to do it:



1 TEST THE DOORBELL
Unscrew the doorbell button to remove it from the wall. Loosen the screws on the back of the button and disconnect the wires. Then touch the two wires together. If the chime rings, the button is bad. If not, the chime, transformer or wiring is bad.



2 REPLACE THE BUTTON
Connect the wires to the new button just as they were connected to the old one. Screw the button to the wall and you're done.



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BUYING tips

BY TRAVIS LARSON editors@thefamilyhandyman.com

IS BAMBOO FOR YOU?

Bamboo flooring has evolved into one of the biggest segments of the wood flooring industry over the past 10 years. That's because it's much cheaper and more durable than most wood flooring options out there. Is it for you? Here's a bamboo flooring primer.

First of all, bamboo isn't wood at all. It's a type of grass, the biggest grass in the world, and there are dozens of varieties. The one most often used for flooring, called Moso bamboo, is from China and other parts of Asia.

Bamboo is processed in a few different ways to make flooring. "Stranded" bamboo is by far the biggest section of the bamboo flooring market. It's made by shredding the stalks into long strands and then compressing them into the final solid form using heat and plastic binders. It's available as tongue-and-groove flooring that's nailed down, or the click-together style, the same choices for most laminate and engineered plank floors. The hardness and durability of stranded bamboo flooring exceed that of any domestic solid wood flooring available. The dozens of colors available allow you to choose flooring that's shaded like cherry, ash, oak or just about any other wood species. However, since stranded bamboo doesn't have natural wood grain, few would mistake it for the real deal.

If you want the actual look of bamboo, choose "horizontal" bamboo flooring. Instead of being shredded, the bamboo stalks are cut into thin strips, which are then laminated together to form the planks. You can see the grain and nodes (the "knuckles" on bamboo stalks) in the flooring. However, horizontal bamboo flooring isn't nearly as hard as stranded, so it isn't the best bamboo choice if your floor will get heavy use or abuse.

The least expensive bamboo option is engineered bamboo flooring. It has a thin layer of bamboo laminated onto plywood, the same type of construction used for other engineered flooring. (You won't find too many choices in this category.)

Bamboo does have a couple of downsides. Because it's grass, not wood, it's more affected by moisture than other flooring choices. It will swell substantially more than wood or other types of flooring, so avoid installing it in damp areas and use care when mopping. And unlike wood flooring, bamboo can never be sanded down and refinished.

You can find bamboo flooring at any home center, but if you want to see a larger selection, go to lumberliquidators.com. You can order it there or use the store locator if you prefer to shop in person.



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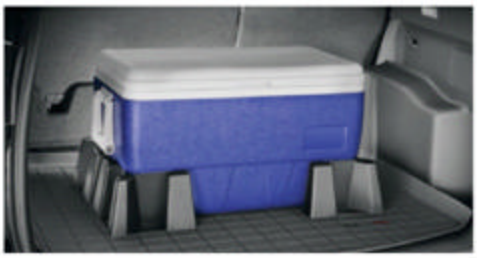
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RECESSED LIGHTING

During our recent bathroom makeover, my husband replaced the outdated bath fan. That meant turning off the power to the bathroom, so he hung his new cordless LED work light between the joists and got to work. After installing the new fan box, he put up new drywall, taped, primed and painted. The bathroom looked fantastic.

His next project was in the basement and one day I found him searching frantically for the work light. So I asked him the standard question: "Where did you use it last?" I could see the "LED" flash on in his head. He had left it in the ceiling above the drywall!



Julie and Scott Ortman



Burned by a free barrel

Many years ago, my mother lived in a tiny town where the residents all burned their trash in barrels. During a visit to her, I volunteered to pick up a new 55-gallon drum and found one for free at a local business. With the rear seats of my Mercedes station wagon folded down, the barrel seemed to fit fine. But when I slammed the hatch shut, the sound of shattering glass reminded me that the rear window angled inward.

That was just the beginning. After delivering the barrel, I learned that there was no Mercedes dealer in the area. So I bandaged the window with duct tape and plastic and headed for home, serenaded for 800 miles by flapping plastic sheeting. The final blow was the bill for the new window: $400. So much for a "free" barrel!



Lloyd Lehn, Ph.D.



Levitating shower

As a new homeowner, I decided to put my do-it-yourself skills to the test by installing a new shower stall. The floor wasn't level, so I shimmed under the base and generously squirted in foam insulation to add support. When I returned to inspect the job several hours later, the base had risen about an inch, lifted by a big blob of foam. Too flustered to think straight, I called my father-in-law, who calmly spent several hours slicing away foam until the base settled back into place. After carefully adjusting the door hardware, it worked fine.

Gregory Knight

Got your own DIY mistake?
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See p. 4.

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